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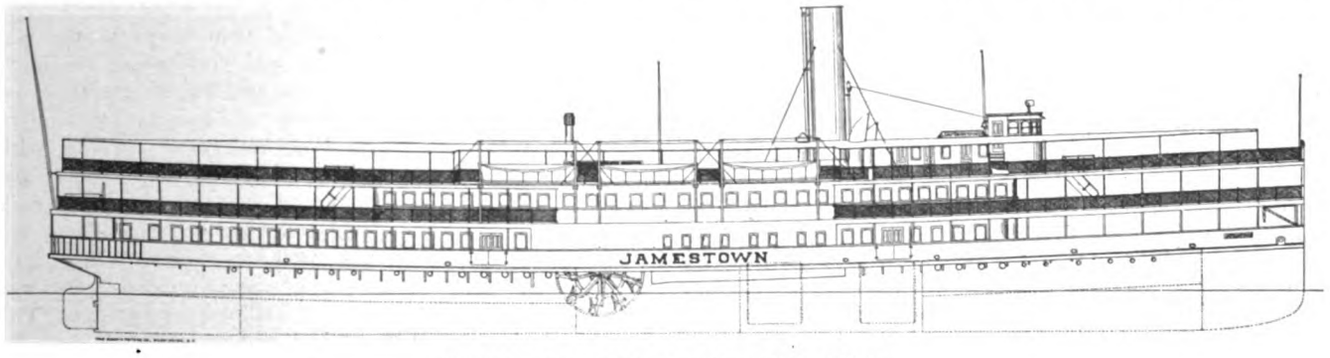
Naval Architects and Marine Engineers

Mr. William Gatewood's paper upon the "Construction of a Fireproof Ferry Steamer" was as follows:

The purpose of this description is to place before the society the particulars of an adaptation of fireproof construction in the building of the Jamestown, an excursion steamer for the Potomac river.

The vessel was built by the Newport News Ship Building & Dry Dock Co., from designs prepared by them to meet the requirements of the Norfolk & Washington Steamboat Co., and was put in service in June last.

The vessel has a length between perpendiculars of 250 ft., length over all of 262 ft., beam over guards of 63 ft., beam molded of 38 ft., and depth molded of 14 ft., 6 in. Plates I to IV show the general arrangement of the vessel. Below the main deck are the barroom, pantry, galley and quarters for the crew. On the main deck are dining room, lobby, parlors and deck space for passengers, both open and enclosed. On the saloon deck are parlors, a few staterooms, toilets, a large enclosed cabin, and some open deck for passengers. On the shade deck are the pilot house and rooms for deck officers, and a large open deck for passengers, covered by awnings. The propelling machinery consists of compound inclined engines, 30 in. and 64 in. in diameter with 66 in. stroke, operating feathering paddle wheels, 17 ft., 3 in. outside diameter. There are four single ended Scotch boilers. The vessel is lighted by electricity. A speed of nearly 19 miles was obtained on the trial trip in Chesapeake Bay.



FIREPROOF EXCURSION STEAMER JAMESTOWN.

By the term "fireproof," is not meant that the vessel is incapable of destruction by fire, but that the amount of combustible material has been limited to such an extent, and what remains is so protected and distributed that the chances of a fire starting on board are greatly reduced; and the spread of a fire would be practically impossible even should one get a start.

No trouble was experienced in this connection with the hull below the main deck, as it was constructed of steel throughout.

The lower deck is built of steel plating 3-16-inch thick laid on beams spaced 27 inches to 30 inches apart, and covered with linoleum, brick, mosaic tiling or interlocking rubber tiling, as the use of the spaces rendered desirable. In the machinery space, the floors are of ribbed plate, set on steel angle supports. The main bulkheads are of steel plate, in thickness varying from 3-16 in. to 5-16 in. and stiffened with steel angles; and the main divisional bulkheads on the lower deck are also of steel plate ⅛-in. thick with angle stiffeners. The minor divisional bulkheads on this deck are of corrugated steel plate of No. 18 U. S. S. gauge, with steel angle boundaries.

The main deck is built of steel plating ¼-in. thick, on steel bearers spaced 24 to 36 in. apart, with the stringer somewhat heavier. The runners under this deck are of steel channels and the beam stanchions are of iron pipe. The covering on the main deck is of rubber tiling or linoleum. The adherence of the rubber tiling or linoleum to the steel deck was obtained by the use of the special cement which it is customary to use for this purpose. The linoleum on this deck where it is exposed to the weather, is secured in addition by thin galvanized steel strips placed on top along the edges and across the joints,

and secured through to the plating by brass machine screws. This latter arrangement is indicated by sketch No. 1 on plate V, and was considered necessary on the exposed deck on account of the liability of water soaking under the edge of the linoleum and thus spoiling the adhesion.

As was anticipated, much trouble was experienced in settling upon the design above the main deck. The following construction of the various parts above this deck was finally determined upon, and seems to have been satisfactory.

The waist or bulwark is built of ¼-in. thick steel plate with wood rail on top, stiffened by the bracketed steel angle supports of the saloon deck, and by intermediate angle stiffeners. Abreast the wheels and in way of the toilet and parlors amidships, the side was extended to the saloon deck by plating 3-16 in. thick, with angle stiffeners.

Where the houses on this deck do not extend to the side, they are built of 5-32 in. thick plating, with angle stiffeners bracketed to the main deck.

The finish inside of these houses was obtained by steel ceiling of No. 24 U. S. S. gauge, secured by brass wood screws to wood grounds bolted to the stiffeners. The wood grounds serve also as guides for the windows. The window sashes are of oak, and the usual wood blinds are replaced by roller curtains. The arrangement of this ceiling is shown by sketch No. 2. The edges of the ceiling were crimped to make a neat finish.

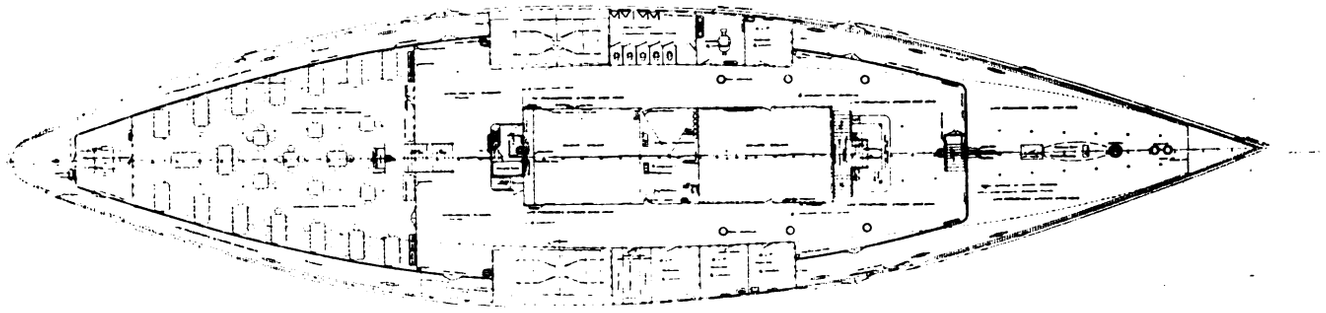
The machinery casings are of steel 5-32-in. thick, with stiffeners alternately angles and tee bars, the latter serving as butt straps and fitted with flanges outside, giving a panel effect. The casings are lined in way of the boiler rooms with No. 24 U. S. S. gauge steel, to which is secured asbestos air cell 1-in. thick to prevent the radiation of heat into the passenger quarters outside. This construction is shown by sketch No. 3 on plate V. It will be noticed that small iron clips were riveted to the stiffeners to take the screws for securing the ceiling, and the use of wood for this purpose in this location was thus avoided.

Air cell asbestos is also fitted under the main deck over the boiler-room, engine-room and galley, resting on metal strips secured to the bottom flange of the beams, to help prevent the transfer of heat through this deck, a result accomplished on other vessels by their wood decks.

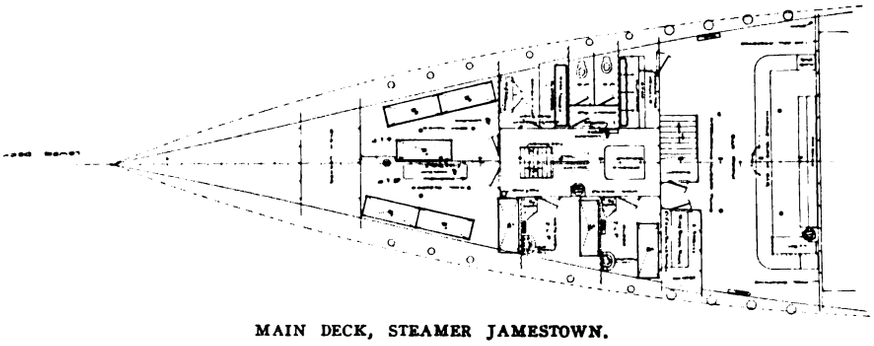
Boundary bulkheads on the main deck are constructed in a similar manner to the casings, and sheet steel pilasters are fitted over the standing flanges of the angle or tee bar stiffeners for appearance sake, as shown by Sketch No. 4.

It was at first considered practicable to build the saloon and shade decks of light steel riveted to steel beams, but after several experimental sections had been built it was decided that exposure to the sun and weather, and the difficulties attendant upon buckling due to the riveting of thin material, would require a thickness of plating of not less than 3-16-in. The weight of 3-16-in. plating rendered the use of such thick plating at this height out of the question on account of the reduction in stability which would have been caused thereby. It was decided, therefore, to use steel angle beams turned upside down, with a pine nailing strip bolted to the vertical flange and resting on the horizontal flange, and on this to lay ⅞-in. pine decking. The under surface of the decking was then covered with thin sheet steel, and a cornice of the same material was fitted over the nailing strip and on the other side of the beam as well, to give a finish. This steel ceiling was not smooth but was rolled with shallow corrugations. The cornice and ceiling were secured by wire nails. As will be seen by reference to sketch 5 on plate V, there is no wood left exposed on the under side of these decks. Steel face plates, stringer plates and tie plates are fitted for these decks, and the runners under the beams are of steel bulb angles, with iron pipe stanchions.

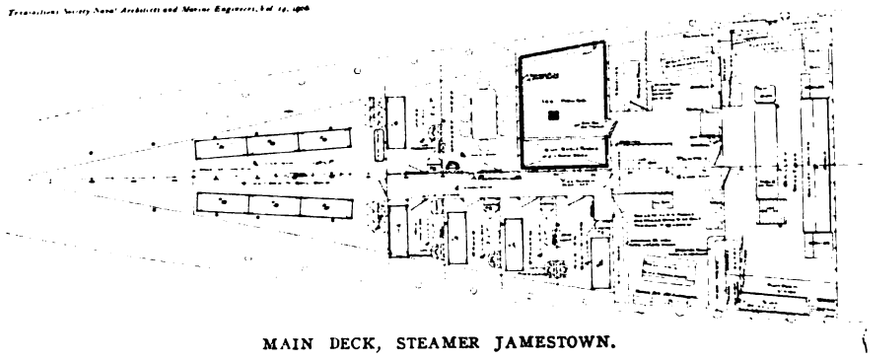
Linoleum was used as floor cover-



LOWER DECK, STEAMER JAMESTOWN.

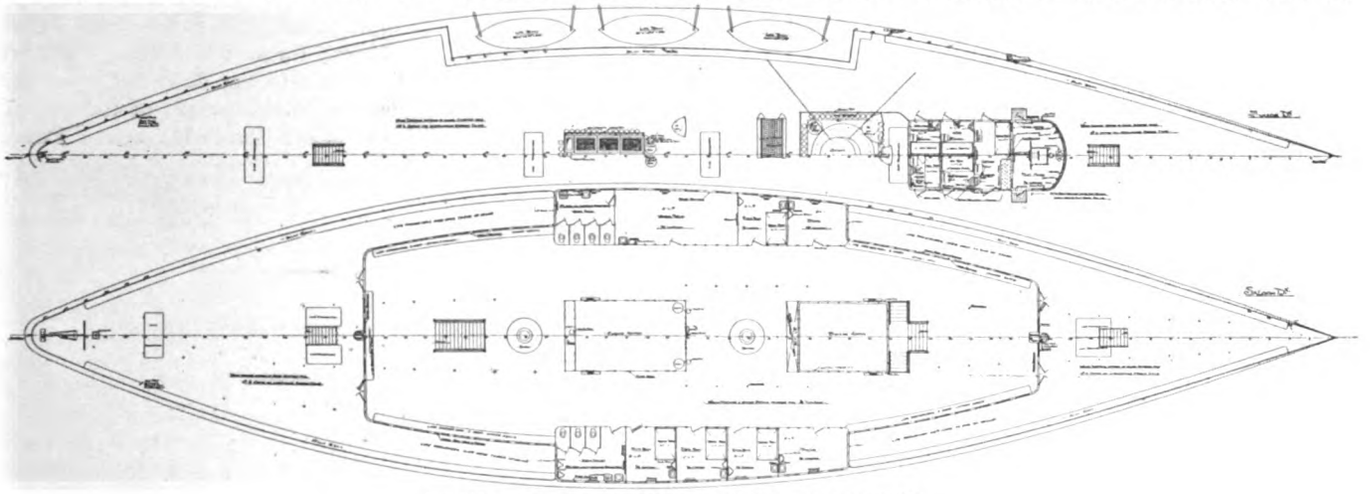


MAIN DECK, STEAMER JAMESTOWN.

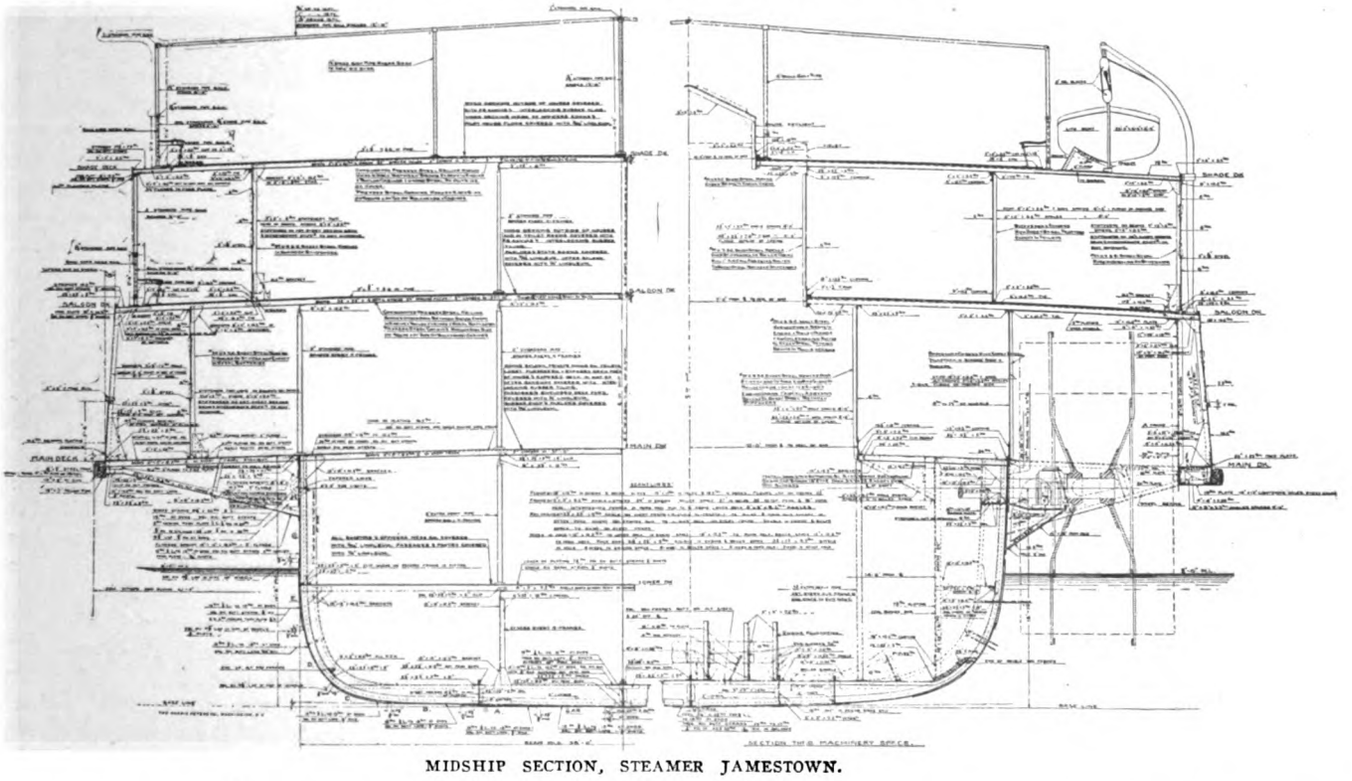


MAIN DECK, STEAMER JAMESTOWN.

ing on the saloon deck where not exposed to the weather, that fitted in the main saloon being of the standard battleship grade, of a thickness exceeding ¼-in. The covering to be used on the exposed portions of the saloon and shade decks was, however, a subject of much consideration. The usual canvas was not considered a satisfactory covering on account of the danger from fire, as lighted cigar ends, etc., have been known to cause trouble on canvas decks. It was thought that some form of asbestos tiling could be used for this purpose, samples were tested and found to be unsuitable, as the asbestos tiles were not tough enough on the surface to stand the wear; and the adhesion between the tiles and the cement used in laying was also defective after exposure. It was finally decided to cover the wood decking with canvas to secure water-tightness, and on this to lay interlocking rubber tiling. This presents an elegant surface, and in general seems to have served the purpose, although some difficulty was experienced on the shade deck, due partly to lack of care in laying and partly to the action of the weather. On account of the weight and expense, the use of interlocking rubber tiling for this purpose leaves much to be desired, even though satisfactory adherence to the deck is obtained. In this connection the suitability of heavy linoleum for this purpose will probably be shown by the small amount which was laid on the exposed main deck of this vessel. Heavy linoleum makes a fine deck covering for protected decks where the surface can be kept coated with shellac. The floor of the main saloon of this vessel, which is fitted with heavy linoleum, makes an excellent surface for dancing. If linoleum is laid on weather decks it would seem necessary to fit metal strips over all the joints, and the surface could hardly compare with that of the interlocking rubber tiling as fitted on this vessel. Sketch No. 6 shows the method adopted for ending the wood deck and its covering at the edge of the waterway at the side of the vessel.



SALOON AND SHADE DECK, STEAMER JAMESTOWN.



MIDSHIP SECTION, STEAMER JAMESTOWN.

The house on the saloon deck is built of 5-32-in. steel plates, stiffened with angles and lined with No. 24 gauge sheet steel in a similar manner to the house on the main deck, and considerable care was taken to bracket the stiffeners to the beams, so that

the rigidity of the structure might be maintained, although the material was so thin. By reference to sketch No. 2 on plate V will be seen how the drip from the windows was led into the waterway behind the ceiling and taken off by scuppers at intervals; and also how the lower portion of the ceiling was made separate so as to be more readily removable for access to this waterway. Divisional bulkheads on all the decks are built of No. 18 gauge sheet steel, corrugated for stiffness, with corrugations about 1¼-in. deep and 8 in. apart.

The pilot house and officers' rooms on the shade deck are built in a similar manner to the house on the saloon deck, with corrugated metal partition between the rooms. Some slight trouble has been experienced with the compass on account of its proximity to so much steel work and it is not quite as quick moving as usual. The expense entailed would not permit of the construction of the pilot house of brass, the only other fireproof material available, as is done on the recent vessels of our navy.

The stairways are constructed of metal and the steps are covered with ribbed sheet rubber. Sketch No. 7 shows the construction. The rails on the stairways are of galvanized iron pipe, and around the wells metal grille work is fitted.

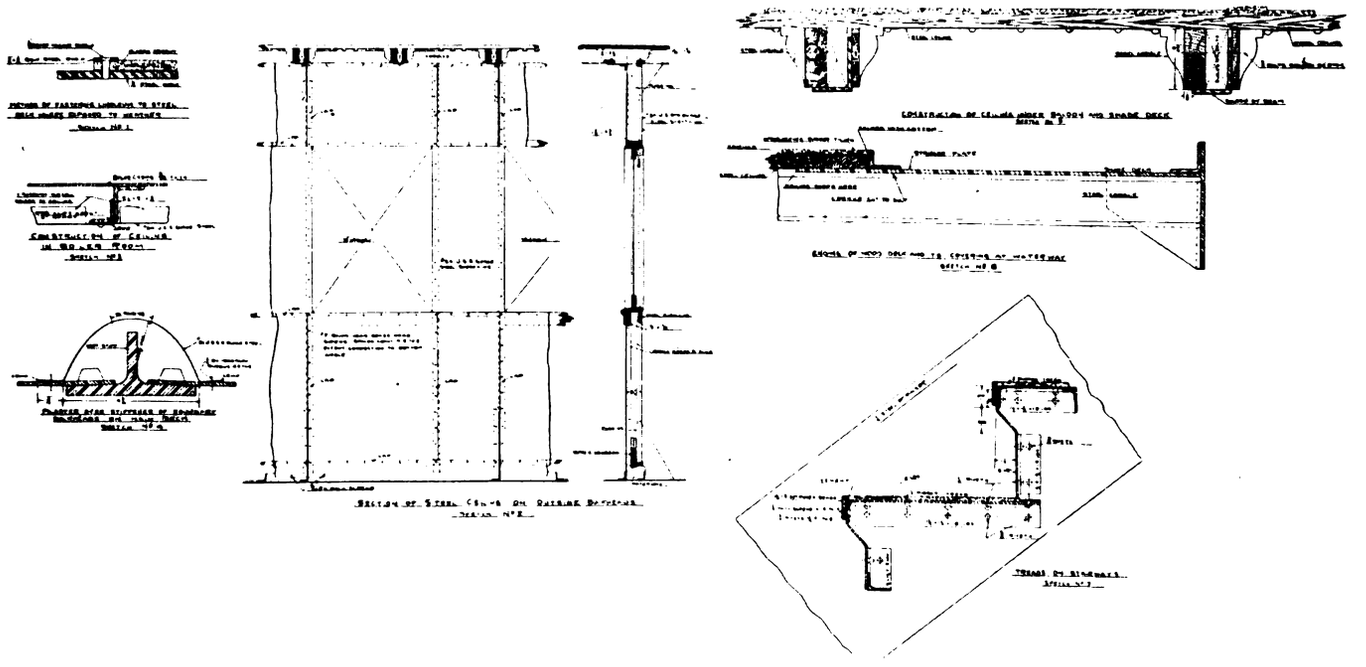
The guard rails are of pipe, with pipe stanchions and with galvanized wire mesh panels.

In connection with the painting, it may be noted that cork was liberally used, as condensation and "sweating" are thereby reduced, and the use of thin metal rendered very necessary the elimination of this cause of corrosion.

The use of wood in the furnishing of the vessel was reduced to a practicable minimum. Bedsteads are of brass or enameled iron, plumbing is of the open type, and clothes lockers are of sheet metal.

The electric wiring is led in steel conduit.

The life preservers, where stowed overhead, are held up by heavy twine instead of the usual wood battens.



DETAILS OF CONSTRUCTION, STEAMER JAMESTOWN.

The construction of this vessel may be summarized as being of steel, the use of wood having been eliminated as far as practicable, and most of the wood that is used is covered with non-inflammable material.

DISCUSSION.

Mr. J. H. Linnard—It is very interesting to us who are engaged in the design of warships to listen to improvements which have been effected in the particular class of vessels which have been under consideration this morning. Of course, for warships the problem of making fireproof construction has been one which has been considered for a much longer period, but has not as yet led to satisfactory results in many respects. We have also in warships the freedom of design involved in the fact that we can compel people to live in the structures we build. One of the difficulties apparent in the passenger boats is that if you do not make the steamer to suit the people who are to go on the steamer, you do not get the people there, which is a very severe limitation on design. The use of corrugated bulkheads dates from a comparatively early period in our own warship construction. The first battleships of the Indiana class had corrugated bulkheads. The appearance of a corrugated bulkhead, however, is not entirely satisfactory, and on some later ships in whose design I was concerned, we had a system of building up light plates with stiffeners of semi-cylindrical form, which, however, we were unable to get down to a weight equivalent to the weight of the wooden bulkheads formerly used. There was not a very large increase, however, but it must be admitted that the wooden bulkheads formerly used on warships were much heavier than those used on merchant vessels, particularly coast and Sound steamers. One matter, perhaps, to which the least satisfactory solution has been given, and I notice the same has been the case with merchant ships, is that of providing a suitable deck that is really fireproof and not excessive in weight. That is due to the fact that the decks have to sustain concentrated loads and the beams which support the flat surface cannot be spaced very closely, and yet the deflection that is obtained with any light steel plate is inadmissible. I think perhaps some of the steel plates which have been used in the boats described here this morning will be found objectionable.

Mr. Gatewood states that the interlocking tiling which was used on the weather decks has not proven satisfactory, and I would be glad to learn if they have yet determined on the substitute they will use for the interlocking tiling on the weather decks. It is true that linoleum, used on most of the warships for the interior, is not

fireproof, but still I think it is not a material that will lead to conflagrations or the rapid running of fire along the decks. Its thinness prevents its gathering the mass of flame and heat that is necessary to produce a conflagration. As far as I am aware, materials that have been produced, of various patent or proprietary names, Xylolith and others, laid on decks, have not proven satisfactory. They generally crack and lead to corrosion under the material.

The president—If there is no further discussion on these papers, we will ask the gentlemen who presented them to close the discussions.

Mr. William Gatewood—In reply to the discussion in connection with the matter of fireproof construction, the only point on which I will dwell is the question of fireproof tiling. We have adopted rubber tiling on ferryboats, double deck boats. A year or so ago a fire occurred on one of the boats and it was reported that the rubber tiling in the saloon deck saved the boat, which indicates that the rubber tiling is fireproof and satisfactory. On the Jamestown, no substitute for the rubber tiling, which we will remove from the exposed deck, has yet been settled upon, and it is possible that no substitute will be provided, but that canvas will remain the cover on the exposed deck. We regretted not to be able to build a steel deck for the upper works of this vessel, but there is no doubt that the weight involved would have been detrimental to the boat, and under the circumstances the vessel is of such construction that there is practically no danger of fire while the vessel is in commission.

The president—The chair ventures to suggest to Mr. Gatewood the desirability, if it meets with his good judgment, of replying to some of the questions asked of Mr. Du Bosque in the general discussion particularly with regard to the additional weight of the construction of the Jamestown and the additonal cost. Possibly Mr. Gatewood will make that addition to his discussion when it is sent to him for revision.

Mr. Du Bosque—Mr. President, first I want to say that I regret very much, that what we expected was going to happen has happened. We were told when we started to design a fireproof ferryboat that everybody in the harbor would be down on us; it would be used as an illustration and give notoriety to the matter of fireproofing of ferryboats, and the public would ask—why are not all the ferryboats made fireproof? Unfortunately, the public cannot see these things in the practical light. Developments begin very slowly; we cannot start out at once and build the most perfect watch or the most perfect locomotive; you have never seen such a thing, and we all know that we must creep in these things. Unquestionably, there is a desire for fireproof boats, and it seems to me there is no easier or more practical place to try the problem than on a ferryboat. To my mind it is the easiest kind of a boat to which to apply fireproof construction, and therefore we thought we were not going amiss in making this step. I think that there is no one, no matter how deeply he has studied the subject, who would prepare the designs and enter into a contract for a fireproof boat like the magnificent Pilgrim and Puritan or the Hendrik Hudson, or boats of that type; but I think the time is not far distant when such a condition will prevail.

To answer the questions which have been asked, in detail, I will say in reply to Mr. Forbes, I thought I had clearly stated that the total cost of the boat was increased seven per cent; that refers to the total cost of the boat. The steel joiner work, if it might be so termed, probably cost twice as much as much as the woodwork would cost. The steel moldings are obtained from the Dahlstrom Door Co., of New York, they are the only concern that make this product. Two or three gentlemen referred to the difficulty of holding the joints and of the method of making the joints of this molding. Our thought was that material, if it is not under strain, will not have its joints disturbed, and these moldings are applied with that thought. They do nothing but act as a border to this asbestos panel which has sufficient strength in itself to hold itself in place. There may be some distortion, but that we will find out with experience. It do not think there will be. The joints are made exactly as in the case of a wooden molding. We use a hack saw with extremely fine teeth and cut them off at any angle or in any shape. In reply to Capt. Miller, I will say that the material weighs 4½ lbs. per square foot, which is about 1½ lbs. more than one-inch wooden border of the same size would weigh. It is much lighter than the panels which we have hitherto used on our ferryboats, because in endeavoring to obtain some sort of fireproof construction we have for the last seven years used a combination of plaster held in place with wire gauze, which is very heavy. These panels weigh only half as much as that form of construction. As for experiments, a quite elaborate test of the insulating quality of this material was made by the Fire Underwriters' Association, of Baltimore, and it was considered by our company to be a sufficient evidence of its fire-resisting qualities. As to the question of moisture, I immersed a piece of this molding in water for six weeks. It absorbed about 1½ per cent of moisture in the first ten hours, and nothing afterwards. That it is fireproof is determined by trying to burn it; you cannot. It does not disintegrate under any heat to which it was applied, which was a torch, a Wells burner. I set a piece of the board up vertically and had a Wells burner which would deliver a flame of about six feet. I placed the burner in front of the board, not more than a foot away, so as to get not only the heat, but the force of the flame, and after six or seven hours there was no evidence of disintegration except the blackening of the face of it.

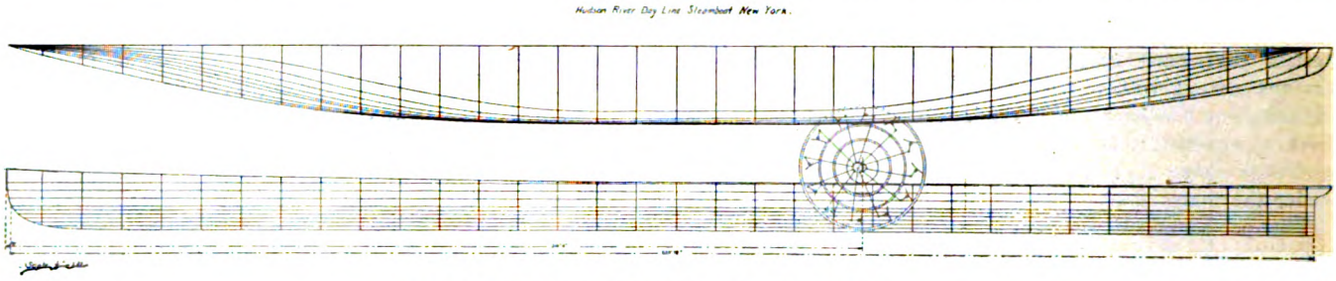
In regard to Prof. Maclean's inquiry, we are now undertaking to design a double deck ferryboat of fireproof construction and have every confidence we will carry it through. Touching on that subject, when I look at the Hammonton, I think I was a novice when I designed it; there are so many places where it can be improved, and so many places where it can be altered and made stronger and built more cheaply; but it was our first effort and the best we knew of at that time. Experience has taught us where a much greater economy in weight and cost can be obtained.

In reply to the next question, as to what ferryboats are equipped with walls and ceilings in the spaces which are occupied by the vehicles, including automobiles, I will say that the Long Island Railroad Co. has two of these boats running on their ferry. It would be a good idea for Mr. Maclean to take a look at them. I will say that the watertight doors in the bulkheads are watertight. After a great deal of persuasion from the New York Ship Building Co. and against our wish, they insisted on using the navy standard for making the doors watertight. So far as the stability of the boats from collision is concerned, that has been worked out, we think, satisfactorily. Any one compartment can be flooded to the water line without any danger of the boat sinking. That is what our rules now require, and ample calculations have been made to determine that fact. Mr. Gatewood has informed Mr. King that rubber tiling will not burn; it is about 96

per cent clay. So far as any inconvenience from sitting on these steel moldings is concerned, I do not think any one in this room would know they were steel from sitting down on them or looking at them. They are molded to the same shape as the wooden moldings we always used, and painted liberally; just now, in this cold atmosphere, and the cabins not heated, they might feel cold, but they are so thin they will surely assume the temperature of the surounding air, and I do not think any one will know they are not wood when he sits down upon them. One word in reference to partitions. I think you are on the wrong tack when you try to use any kind of metal partitions. A partition, a wall, should not be made a supporting structure. It is something to keep your eye from going into the next room, or air circulating from one room to another, or something of that kind; simply a division plate and many materials can be used for that. The way to improve on fireproof construction is to depart entirely from everything that has been taught us by naval architects, and take a few lessons from bridge builders. A boat builder has got to follow out the designs that bridge builders follow. I think if any of us, who think we are naval architects, would look at the framing of a windmill we would say—how in the world does it stay there? Yet it does, it looks as if it was put up on strings. There has been a rational system in the employment of the section of metal in the case of a windmill.

I do not know how to reply to Capt. Taylor. He says he does not approve of this fireproofing business, and yet as these fires occur on his boats he wants to know how to make them fireproof. I think in his case this is to be said—the reason that the Fall river line has not had any trouble from fire, is because they have been so eternally vigilant in their fire patrols. Nobody ever woke up at night on a Fall river line steamer and walked out of his stateroom but was surprised to see the number of men posted around the ship, for no other purpose than to watch for fire and other danger.

In reply to Mr. Dickie, there are very few places on this ferryboat where the paint cannot be applied without taking down something else to get at it. I think Mr. Dickie is very familiar with this boat, as he is stationed at the ship yards, and I believe if he will think it over he will realize that only behind some of these panels on the sides is where the iron work cannot be got at to paint, so that we do not expect what might be called interior corrosion. Mr. Dickie has also walked on the upper deck of this boat, and I do not think he has found any vibration there. I have tried to discover this vibration, with three or four others alongside of me, and we have not succeeded. We think it is entirely too stiff, and on another boat we will make it lighter. In reply to Mr. Wheeler, I will say the fire which occurred on the New Jersey Central boat was not such a serious fire as he was led to believe. The fire may have looked as if it was on the deck of the boat, but it was not; it originated in a locker beneath the staircase, which the porters use for stowing away mops and brooms, and the stuff which they use for cleaning the cabins; it is supposed that one of the materials they used for cleaning the brasswork, being of a very inflammable nature, caught fire spontaneously, as there was no evidence to trace any one as having been in the closet at that time, though there was ample evidence to show that the fire was started



HUDSON RIVER DAY LINE STEAMBOAT NEW YORK.

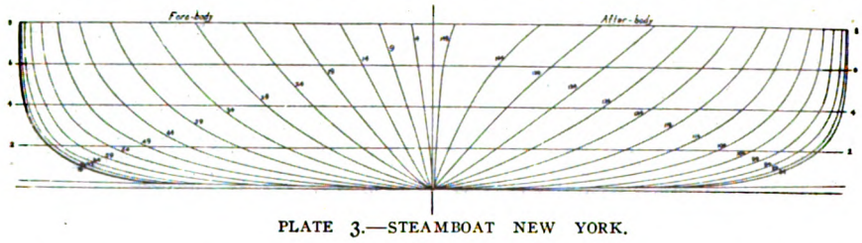
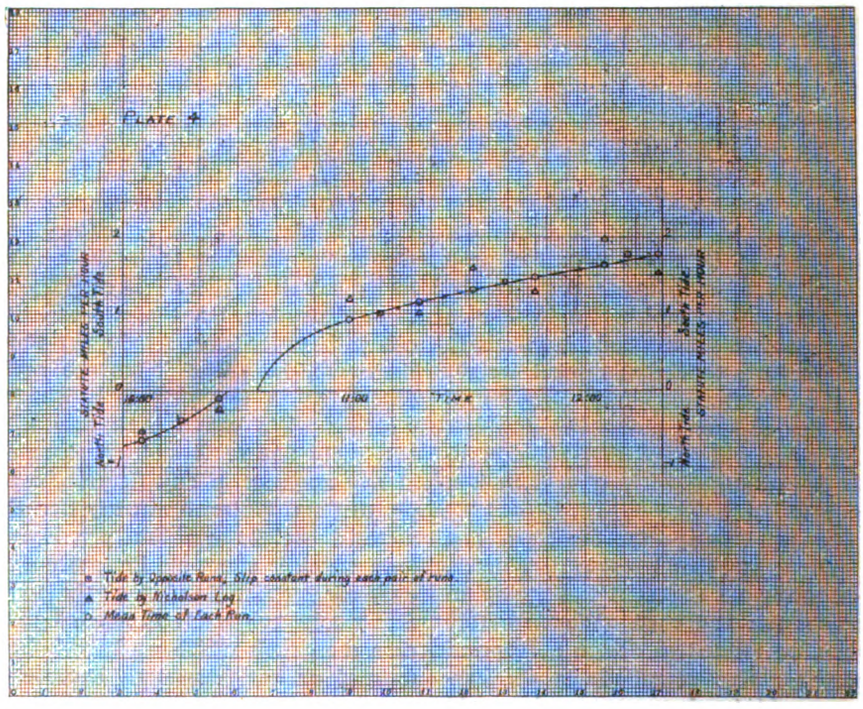


PLATE 3.—STEAMBOAT NEW YORK.

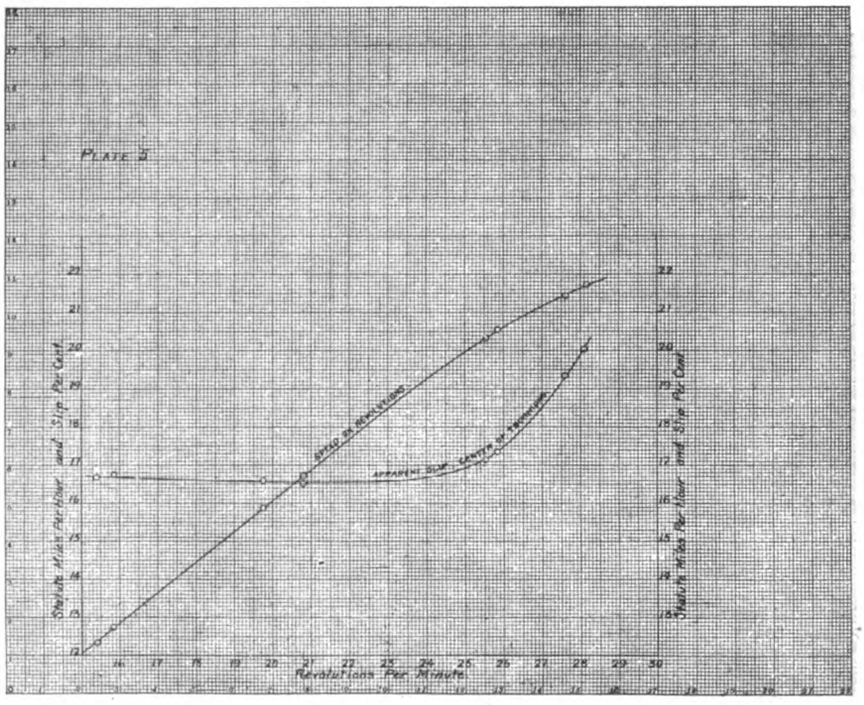


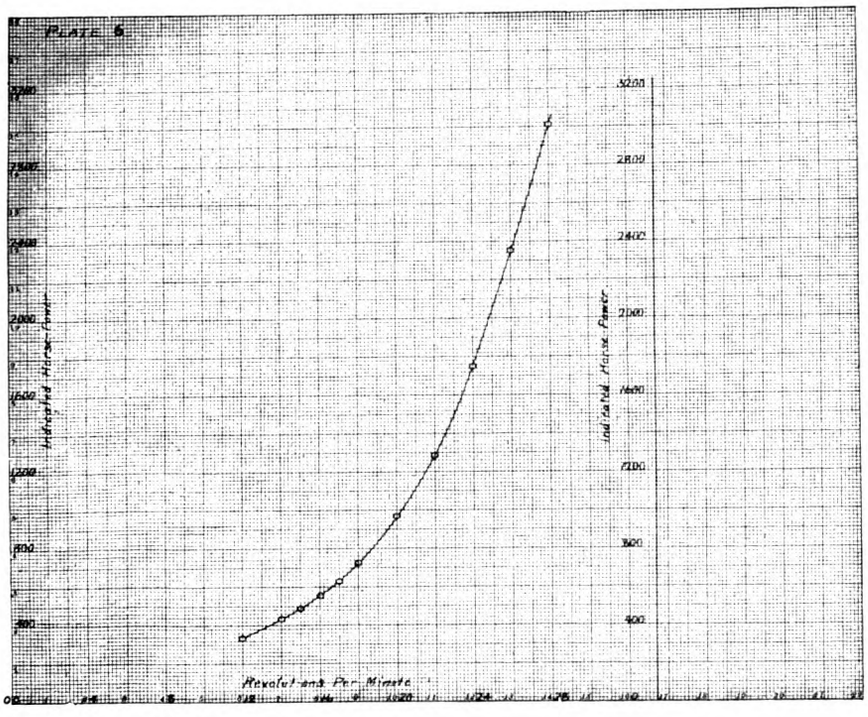
in the closet. Since then the closets on the ferryboats are lined with asbestos material. In reply to another gentleman, we are using sand all over the ferryboats, provided in buckets, principally brought about by the fact that the only known way to extinguish a gasoline fire is to sprinkle sand over it, and all boats are equipped with a sand tank on each end for that purpose. I think that covers the ground.

The president—There has been no discussion ever taken place in this society of greater importance to the public than this one this morning, and it is undoubtedly in accordance with your wishes that a vote of thanks should be extended to the gentlemen who contributed these interesting papers.

Mr. W. P. Stephens—I believe I have attended every session of this society since it was organized, and I think I am safe in saying that this is the first session at which nothing has come up in connection with the gentle art of killing people. I do not want to depreciate the naval end of it, but we have devoted the whole morning to the art of saving people; and I wish to move a vote of thanks to these two gentlemen for the very valuable papers which they have presented, and which we hope is the beginning of a much broader movement in this direction. (Motion seconded.)

The president—In putting this motion the chair feels it will be in accordance with the feeling of the members that we should also express our obligation to those in responsible positions who have taken part in this discussion. We all know that many of these gentlemen have considered this subject in view of the grave responsibilities that have fallen upon them, with great care and for many years, and that their consideration of the question has not only been influenced by such things as has brought about the building of this ferryboat, but by their sense of responsibilities, and their investigation of their subject has been diligent and continuous and entirely without regard to questions of cost. All those in favor of extending this vote of thanks please say Aye; contrary-minded please say No. The motion is unanimously carried.





PROF. JAMES E. DENTON'S PAPER.

Prof. James E. Denton's paper on the "Performance of the Paddle-Wheel Steamboat New York of the Hudson River Day Line," was then read as follows:

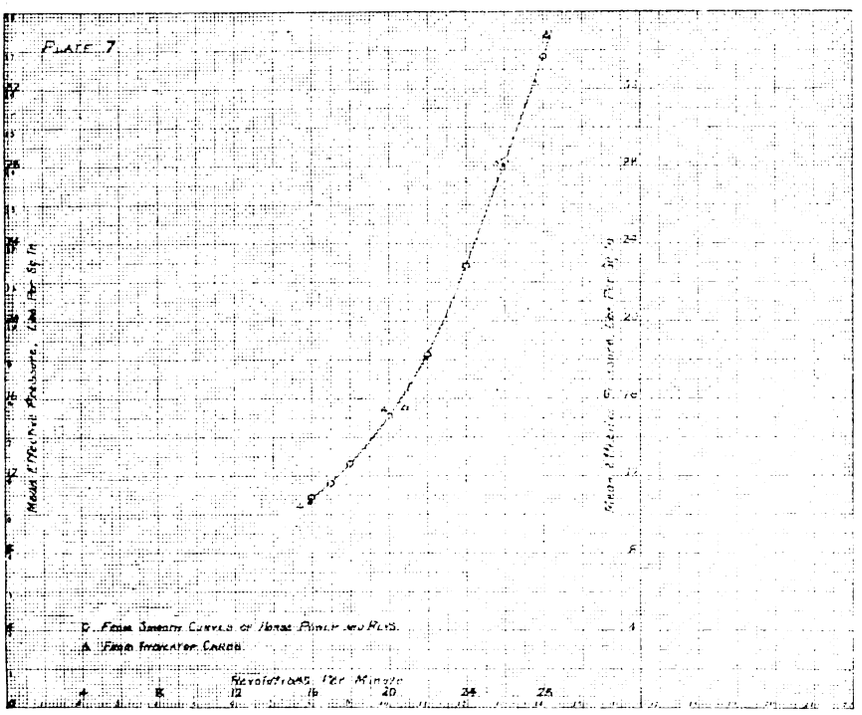
"Ever since the advent of the Clermont made the Hudson river the birthplace of steam navigation as a remunerative art, the passenger traffic of this river has practically adhered exclusively to the use of the single-cylinder, vertical, low-pressure, paddle-wheel engine which Fulton adopted.

"In the development of this type of engine in day-passenger service on six feet of draft, the advent of the Mary Powell, in 1861, represents the maximum speed attained with radial paddles, and a diameter of wheel sufficient to afford a speed of about 20 statute miles without exceeding 25 revolutions per minute.

"In the further development for speed since the date of the Mary Powell, the New York, built in 1887, represents the best which has been accomplished, with wheels about as large as those of the Mary Powell, but fitted with feathering paddles. In the latest development represented in the recent advent of the New York's magnificent sister boat, the Henrick Hudson, the historical type of engine is supplanted by the high-pressure, inclined, compound system using feathering paddle-wheels of so small a diameter that an engine speed of upward of 40 revolutions per minute is required. I have therefore ventured to think it appropriate at this time to present the re-

sults of speed and power trials of the New York made at the request of the owners, as a contribution to the information desired in designing the new boat.

"The tests were made during the spring



of 1903, just after the boat had left the dry dock for the season's service. They consisted of a progressive speed test with opposite runs over a straight course off 96th street, and a continuous river test from New York City to Poughkeepsie."

GENERAL DESCRIPTIONS AND DIMENSIONS.

The general appearance of the New York is shown by Plate 1. The hull is of steel, with lines as per Plates 2 and 3. The engine is of the single-cylinder, walking-beam type, to which slightly superheated steam at about 40 lbs. pressure is supplied by three return-flue boilers operated under natural draft and artificial draft when necessary by air at about 1.5 in. pressure delivered into closed ash-pits.

Diameter of cylinder	75	in.
Stroke of cylinder	12	ft.
Heating sur. of boilers, tot.	5,499	sq. ft.
Grate surface of boilers, tot.	228	sq. ft.
Length of hull on water line.	330	ft.
Draught from top of keel during tests	6	ft.
Beam on water line	40	ft.
Area of midship section	216	sq. ft.
Displacement	1,240	gross tons
Block coefficient	0.584	
Wetted surface	11,250	sq. ft.
Outside diameter of paddles	29 ft.	10 in.
Diam. to center of trunnions.	27 ft.	0 in.
Width of paddles	3 ft.	4 in.
Length of paddles	12 ft.	6 in.
Number of paddles	12	
Dip of paddles	4 ft.	5 in.

PROGRESSIVE SPEED TRIAL.

This was made over a course which I have frequently used in previous tests, lying between 96th street and 129th street.

The lines of these streets are parallel and clearly defined, so that by running at right angles to them, about 700 ft. from the shore, a course is afforded 0.85 statute miles in length by the coast survey chart, with a depth of water increasing from 48 ft. at 96th street to 68 ft. at 129th street.

Opposite runs were made at four speeds, commencing at about fifteen revolutions per minute, and ending with about twenty-eight revolutions, the latter being the highest speed that could be maintained by the boilers (see boiler pressure, column 4, Table A.) The detailed speed data are given in Table B, and the complete results in Table A.

The trial speed, column 11, Table A, is deduced for each separate run, by applying to the apparent speed the time value given by the curve of Plate 4. The latter represents a smooth line parallel to the mean tide computed in column 8 of Table B, but lying below these values at the higher speeds, to allow for the increasing slip shown by the slip curve of Plate 5, the effect of which can be computed by a modification of the tide formula attached to Table B. As, however, fractional revolutions are not determined, this refinement is rather chimerical.

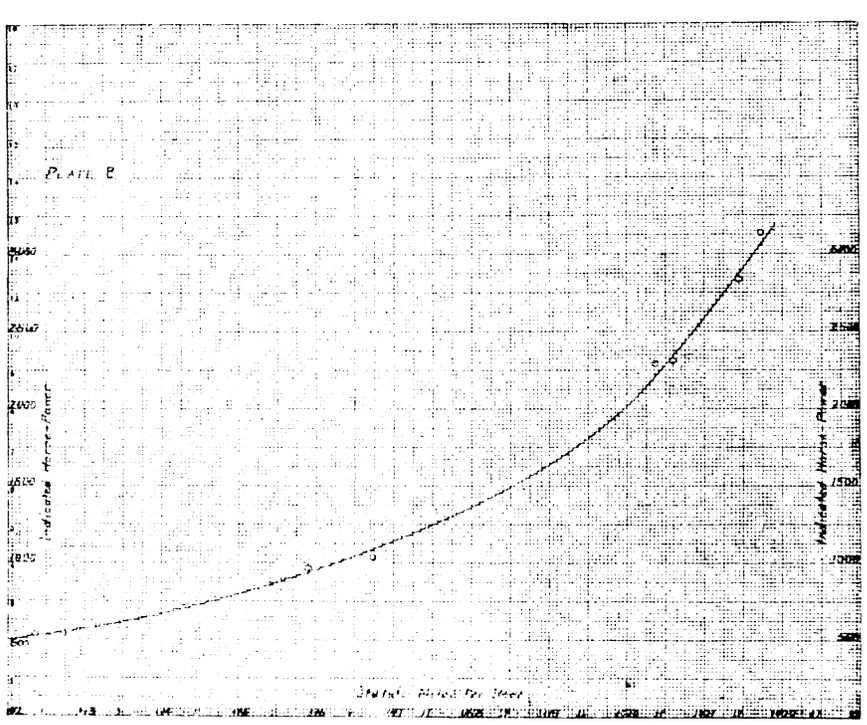
Curves of speed, horsepower, and mean effective pressure on revolutions are shown by Plates 5, 6 and 7, and horsepower on statute miles by Plate 8.

Simple indicator cards are given in Plate 9, and their uniformity during each run is shown by Table C.

RIVER TRIAL.

This was a continuous run from Desbrosses street to Poughkeepsie, a distance of 74.21 statute miles as determined by carefully scaling the path of the boat on standard charts. The trip was timed so that the boat carried a flood tide throughout the run. The run was made in the exceptional time of three hours, thirteen minutes and twenty seconds, notwithstanding the speed was handicapped by abnormally low steam pressure over a considerable fraction of the trip and by several slow-downs.

The detailed data are shown in Table D, and also graphically by the Nicholson



log chart, Plate 10. The latter shows very strikingly how impossible it is to maintain a steady speed in a crooked stream like the Hudson river.

Column 7 of the table gives an ap-

proximate indication of the great variation of tide involved in a river trip. For instance, in the narrowest part of the river approaching West Point where the depth (column 14) is over 100 ft., the tide is so strong that the speed along shore (column 8) is 25.42 miles, whereas the true speed as deduced from the progressive trial (column 16), or from the Nicholson log, column 9, is only about 21.5 miles.

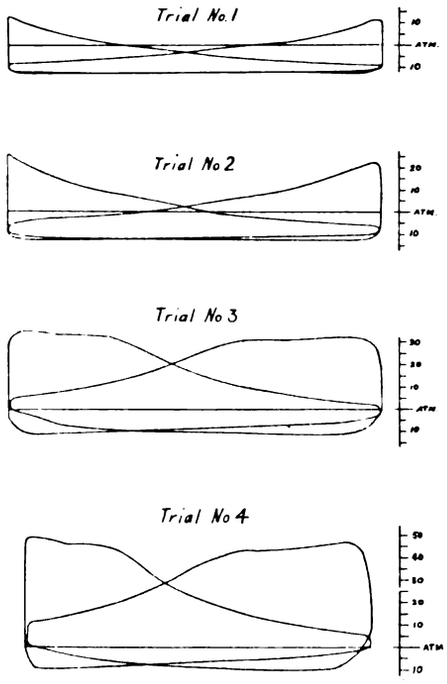
unsatisfactory means of determining the true capacity of the boat.

DISCUSSION.

Vice President Stevenson Taylor (in the chair)—It is a great pleasure to receive a paper from Prof. Denton, and we are sorry he is not here himself to present the paper. If there is no discussion upon this paper I would like for the sake of the record to call attention to the fact that the steamer New York, as described by Prof. Denton, is different from the steamer as at first constructed; in other words, there were 30 ft. added to her length, put in at the widest part of the boat, which has changed the result some, but not very materially, when you consider the change in the boat and the greater carrying capacity. The dimensions originally, in 1887, were: Length of hull on water line, 300 ft., now 330 ft.; beam on water line, 40 ft., now 40 ft.; draught from top of keel during tests, 5 ft. 10 in., now 6 ft.; displacement, 1,000 gross tons, now 1,240 gross tons; block co-efficient, 0.584, now .56; outside diameter of paddles, 30 ft. 2 in., now 29 ft. 10 in.; diameter to center of trunnions, 27 ft., now 27 ft; width of paddles, 12 ft. 9 in., now 12 ft. 6 in.; dip of paddles, 4 ft. 2 in., standing, 4 ft. 6 in. running, now 4 ft. 5 in.

During the month of May, 1888, over

SAMPLE INDICATOR CARDS OF PROGRESSIVE SPEED TRIALS

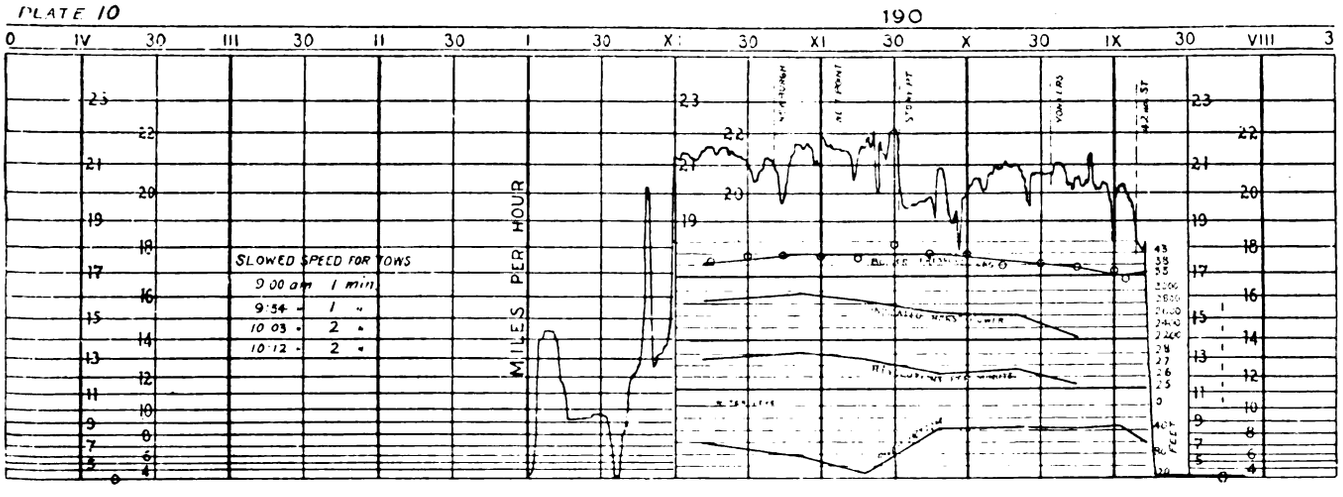


a range two miles on the Hudson river, one mile up and one mile back, 22.8 statute miles per hour were traveled, the engine making 30¾ revolutions per minute, and developed much more power than was developed at the time of Prof. Denton's trial. The average of three runs, one run of one mile, and two runs of two miles, was 22.50 statute miles per hour, with 29.66 revolutions per minute, which was a better performance than at present, due, of course, to the same power or greater power and lighter weight. I wish to call your attention to one particularly strong feature of this style of steamboat and machinery. It was a great struggle to get 1 horsepower out of 1 sq. ft. of grate area, but you will see by Prof. Denton's own figures that he has exceeded that, showing 31.25 H. P. developed for quite a period of time on 228 sq. ft. of grate area, making 13.7 H. P. per sq. ft. of grate area, and not having a compound or triple-expansion engine either.

One other point in his paper I think deserves particular attention, that trials of speed, while they may produce sensational records, are not a very satisfactory means of determining the average capacity of the boat. You will see from time to time, as I have for the last thirty years now, a statement of the extraordinary speed of steamers made on the Hudson river, in times gone by, and no steamer at the present time really averages the speed of these other steamers. I think you will invariably find, if you look up the facts, that the steamers made the fast runs under exceptional circumstances, with a strong favorable tide and an exceptionally strong favorable wind. The effort has always been made on the Hudson river to make the steamers fast by selecting particular tides and winds, so that Prof. Denton's comments are particularly appropriate and well worth remembering when you read about the so-called actual speed of steamers in the years gone by.

Mr. J. R. Andrews—I would like to make a suggestion, if it meets with the approval of the members. In view of the very able and comprehensive manner in which the secretary of state, Mr. Root, has advocated the passage of the subsidies bill, which I think is of great interest to all naval architects, I would like to make a motion that a committee be appointed to draft suitable resolutions of thanks to the secretary, and that something of that kind be engrossed and forwarded to the secretary on this subject. I would like to hear an expression of opinion of the members on this

PLATE 10



NICHOLSON LOG HUDSON RIVER DAY LINE STEAMBOAT NEW YORK.

It also appears that the highest revolutions did not occur during the period of highest steam pressure, and the highest speed of boat did not coincide with the highest revolutions per minute.

These inconsistencies, which are caused by variable conditions of current and channel show that long distance river trials of speed, while affording opportunity for sensational records, are an

point, and if they agree with my suggestion, I would like to see something of that kind done before the meeting is closed.

The Vice President—Will you kindly present that at the close of this paper—it is not germane to this subject.

Mr. Andrews—I thought you had finished with the discussion.

The Vice President—I am through, but perhaps the members of the association are not. I will ask the president to resume the chair, as he referred to Secretary Root in his opening speech and is better able to preside during any discussion of that subject.

Mr. G. W. Dickie—Does the lengthening of that vessel account for the unusual position of the wheels?

The Vice President—The lengthening was put in between the boilers and wheels.

Mr. Dickie—Was there any observation made in regard to what effect that had, where the crest of the wave generally occurred?

The Vice President—You will notice, if you compare the figures I gave and the figures given by Prof. Denton, that the wheels have been reduced in diameter, due to that fact.

Mr. Dickie—I did not notice it, but it is important.

Mr. D. W. Taylor—I would like to ask a further favor from Prof. Denton, which would add to the value of the paper for the records of the society. I notice on Plate 10 he gives curves of speed based on depth of water, but apparently that has not been extended into very shallow water. Apparently there is nothing shallower than 40 feet. I refer to the last page of the paper. As this class of steamer frequently runs in shallow water, in fact more often in shallow water than deep water, I think it would add to the value of the paper if some further data were given, if Prof. Denton can supply it, which would connect a little more the revolutions with the depth of the water. That is the only suggestion I wish to make in connection with the paper.

In connection with your remarks, Mr. Chairman, about the speed of the Hudson river boats, as the Mary Powell is referred to in this paper, and we have all heard, or very many of us here have heard so much about the speed of the Mary Powell, I would say that I have had an opportunity in the last year or so of trying a model of the Mary Powell. There is some doubt as to what the lines of the Mary Powell were. I was given the lines of what was supposed to be the Mary Powell and we tried them, and it is true, comparing the results of that model and the results of other river craft, she showed up exceedingly well, perhaps the best model of that type we have ever tried, which confirms to some extent the popularity of that type of steamboat.

The Vice President—There has not been any doubt of that in my mind. I think it will be very difficult for Prof. Denton to give you what you ask, for the depth of water mentioned, so that you can compare the speed and the depth of water at the same time, on account of the crooked courses followed by the boats in traversing the Hudson river. Is there any further discussion? If not, I think a motion to pass a vote of thanks would be in order.

Mr. Dickie—I move that a vote of thanks be passed to Prof. Denton for his interesting paper. (The motion was seconded and duly carried.)

The Vice President—I will now ask the President to resume the chair.

(President Bowles in the chair.)

The President—Gentlemen, you heard the suggestion of Mr. Andrews, and the matter is open for discussion.

Mr. Dickie—I suggest that Mr. Andrews repeat what he said.

The President—Mr. Andrews, will you be good enough to again lay that matter before us?

Mr. J. R. Andrews—My idea was that it would be fitting for this society to convey a set of resolutions, properly prepared, to Secretary Root, voicing the sentiments of the society on the very able speech made by him at Kansas City before the Trans-Mississippi Commercial Congress. The speech was reported very fully in yesterday's *Sun*, and the reasons which he gives that some assistance should be given the shipowners and shipbuilders in this country are so logical that it seems to me it is a matter of a great deal of interest to this society. Personally I should like to see some notice taken of it. I make this simply as a suggestion.

Mr. Aldrich—Can we not accept that as a formal motion? If so, I second it.

The President—It is moved and seconded that a committee be appointed to draft suitable resolutions for this purpose. Those in favor say aye; those opposed, no. (The motion was carried.) The Chair will announce the committee later. This session will now stand adjourned until ten minutes of two.

A NEW FLOATING WORKSHOP.

A remarkable vessel for the royal navy is, says the *Glasgow Herald*, being fitted out alongside the ship yard of Sir James Laing & Sons, Sunderland. She is the sequel to an experiment made some time ago, when an old cruiser was converted at Portsmouth into a floating workshop, under the name of the Vulcan, to attend on a fleet at sea for the execution of repairs. The experiment has evidently been very successful, as the vessel at Messrs. Laing's is specially built for the same purpose on much extended lines. It would, in fact, not be inapt to describe her as a sea-going dock yard, so extensively is she being fitted with shipbuilding and engineering machinery. The men working on her say there is not a machine to be found in a ship yard or marine engine works that is not represented on board. Considerable secrecy has been preserved with regard to the vessel, all the officials concerned in her construction having been sworn under the officials secret act. She was launched without ceremony some months ago, and named the India Brahma, a name which might suggest that she was meant for an eastern trader, but her internal fitting is now so far advanced that her purpose is obvious, and she is now officially referred to as H. M. S. Cyclops. Externally what most distinguishes the vessel is the number of funnels, and the position of some of these. The latter are to carry the smoke from the foundries and workshops below. The vessel is of 11,000 tons, and her dimensions are: Length, 460 ft.; breadth, 55 ft., and depth, 40 ft. She has huge hatchways leading to decks below almost for her full depth. At the lowest level is a fully equipped foundry, with cupolas, where damaged parts of machinery can be replaced by new castings. The capacity of the foundry is adequate to deal with moderate-sized shaftings. On a higher deck is a boiler shop, where boiler and ship plates can be dealt with, and where there are shearing and punching machines just the same as in a shipyard. Then there are carpenters', blacksmiths', and armorers' shops, fully equipped fitting works, and electricians' and coppersmiths' departments. There is a crane which travels all round the ship, to lift the repairs to and from the works below. The vessel has a large ice-making plant, and a set of gigantic condensers capable if need be of supplying a fleet with fresh water. An important part of the ship is the electricity generating station. All the machines and cranes will be worked by electric motors, and the vessel will be fitted with wireless telegraph apparatus. She will carry a crew of about 300 men, mostly artificers, and is expected to be ready for sea about Easter.

Mr. James J. Gilroy, of South Brooklyn, has the contract to install two new Roberts safety water-tube boilers in Commodore Benedict's steam yacht Oneida.

BRAZING.

BY E. A. SUVERKROP.

In spite of the fact that there are hundreds of brazed flanges on the average steam ship it is surprising how few engineers know anything at all about the job. This is no doubt due to the feeling among engineers in general of "every man to his own job." The ability to do a fair job of smith work is no doubt of great assistance to the engineer at times and why should he not be able to do a fair job of brazing? Brazing is considerably easier than smith work. I would undertake to make a good brazer of any intelligent man in from twenty minutes to an hour, but who could make a smith of a man in that time?

I will first take the general principles of brazing under consideration. Brazing is the joining together of two pieces of metal by means of another metal having a lower melting point. It is practically the same as soft soldering excepting that it is done at a higher temperature and the solder or spelter used in an alloy of copper, tin and zinc or copper and zinc instead of tin and lead. The joints to be brazed should be as nearly clean bright metal as the job permits. Grease and dirt are antagonistic to a good job. The parts to be brazed should be securely held in relation to each other, either by pins put through them or by wiring to each other or by other means. The heat applied should also be clean. Hard coal fires are fairly good, a fire of soft coal charred is also good, but perhaps the best is a gas and air blast. Gasoline or oil blast also give good results.

In brazing a flux must be used. Formerly borax in one form or another was the only thing that would do. Some brazers used it powdered, some in crystals, some mixed it with water, some didn't. Some melted it in a crucible; it was then called "burnt" borax. It was then broken to various degrees of fineness according to the individual whim of the brazer, each one of whom would declare that his way of breaking the borax was the prime reason why he produced good work. The drawback about borax is that while it is a good flux it becomes as hard as glass after the job is cold. In this state it is difficult to remove and ruins the hardest file. A better flux than borax in any form a boric (also called boracic) acid. It comes in crystals or powder. I prefer the crystals for some work as the powdered form is apt to curl up and blow away while the crystals do not. Boric acid does not form a hard scale and if you know how to handle it does not leave any scale that cannot be almost rubbed off with the hand.

In jointing up ready for brazing the joints need not leave room for the brass to run in. They can be drive-fits, for if the heat and flux and spelter be applied in the right manner the brass will run into the tightest joint. The beginner however, better not fit his pieces too tight; just make them an easy drive fit, put one or more pins in to hold the pieces together.

We will assume that we have a steel flange to braze on a steel pipe. The flange has been bored or filed to fit on the end of the pipe which has also been filed or burned bright, the joint is clean, bright metal to metal. The job should be put in the fire so that the pieces are heated as evenly as possible. In this case we will assume (what is generally the case) that the flange is heavier than the pipe. It stands to reason that it will not heat as quickly as the pipe which is lighter, we therefore heat the flange first, placing it in the hottest part of the fire. While the heat is coming up the brazer applies the flux to the joint with a brazing "spoon." I generally make my brazing spoons out of a piece of ¼ or 5-16 inch iron rod of suitable length, say two feet, with the end heated and beaten out flat about ⅝-inch wide by 1¼ inches long. As the heat increases and the flange and pipe become a dull red the flux melts and runs all over the job, some of it runs into the joint where we want it but the bulk of it is lost. As it is cheap this does not signify. When the job reaches a so-called cherry red, that is to say, a heat at which one would temper a chisel, it is time to put a little spelter on as this heat is very near the melting point of the spelter. The spelter is applied with the spoon together with more flux and is guided into the top of the joint by the spoon. In a few moments the brazer will notice that the spelter has begun to flow and run about all over the joint almost the same as mercury. The heat is kept on a little longer, say a minute or so according to the size of the job, while more spelter and flux is applied. The job is then lifted from the fire, being handled carefully so as not to jar it, and while still red hot the flux is brushed off with a steel brush. This treatment applies especially when borax is used as it eliminates a good deal of hard work later. The job is then allowed to cool till it is at such a temperature (a dark red) that immersion in water will not harm it. It is then put into a saturated solution of sal soda water or strong soap water. When cool the scale is easily brushed off, leaving the steel and brass clean and bright.

The spelter to be used varies according to the material on which it is to be used. On steel any kind of brass can be used, as the melting point of any brass is below that of any steel. I have also brazed steel with copper when no brass was at hand.

For brass and copper a soft brass with a low melting point must be used and great care must be exercised in order to avoid melting the job itself, especially so if it is brass, as the chances are that there may not be much difference between the melting points of the job and the spelter.

It is often desirable to repair a piece of cast iron that has been broken. A great number of very good brazers assert that cast iron cannot be brazed, and an equally large number of people having some patent process or another assert that it can but only by their particular method. Both are wrong. cast iron can be brazed with common brass and common borax or boric acid. There is no mystery about it. The joint should be thoroughly clean, the pieces should be firmly pinned together so that they cannot alter their position with relation to each other, the heat should be applied slowly and steadily while plenty of flux and spelter are applied and the job should not be hurried in any way. Let the job stay in the fire for a long time, to use a blacksmith's phrase, "Let it soak in the fire." A braze made in this way will be just as good if not better than one made by any of the patented or secret (?) processes.

A DISCOVERY THAT WILL STARTLE THE ENGINEERING WORLD.

M. W. H. Hunter, engineer of the Manchester Ship Canal Co., in his inaugural address as president of the Manchester Association of Engineers, spoke of a new relation between engineering and the general community. He also alluded to a new and important source of energy, and concluded: "I speak with some measure of confidence when I say that it is possible that at no distant date the engineering world will be startled by the revelation of a discovery relating to motive power of such sort and of such far-reaching consequences, that if I were permitted to describe it to you, you would agree that it may of itself go far to establish the proposition which I have submitted to you this evening."

THE MARINE REVIEW

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December 6, 1906.

PRESIDENT ROOSEVELT ON AMERICAN SHIPPING.

(Extract from his annual message to Congress, Dec. 4, 1906.)

"Let me again call the attention of the congress to two subjects concerning which I have frequently before communicated with them. One is the question of developing American shipping. I trust that a law embodying in substance the views, or a major part of the views, expressed in the report on this subject laid before the house at its last session will be passed. I am well aware that in former years objectionable measures have been proposed in reference to the encouragement of American shipping; but it seems to me that the proposed measure is as nearly unobjectionable as any can be. It will, of course, benefit, primarily, our seaboard states, such as Maine, Louisiana and Washington; but what benefits part of our people in the end benefits all, just as government aid to forestry and irrigation in the west is really of benefit, not only to the Rocky Mountain states, but to all of our country. If it prove impracticable to enact a law for the encouragement of shipping generally, then, at least, provision should be made for better communication with South America, notably for fast mail lines to the chief South American ports. It is discreditable to us that our business people, for lack of direct communication in the shape of lines of steamers with South America, should in that great sister continent be at a disadvantage compared to the business people of Europe."

A DESERVED REBUKE.

For years there have appeared in the newspapers of the country items foretelling the intention of Congressman Burton to "fight the ship subsidy bill." He has been held up as the bugaboo man to the friends of American shipping, as the dragon for whose advent we must "watch out!" Congressman Burton seems to have enjoyed the prominence his foretelling has given him, and to have reached the conclusion that the fate of the shipping bill was in the hollow of his hand. THE MARINE REVIEW cannot have it understood too plainly that we concede to Congressman Burton a perfect right to oppose the passage of any measure that he deems against public policy, inclusive of the ship subsidy bill. It is his privilege, too, which we do not wish to deny him, but which, on the contrary, we are perfectly willing he shall indulge himself in to the limit, of exploiting his opposition to the shipping bill however and whenever he chooses. We only say that, in going out of his way to announce for years in advance of the consideration of such a measure in congress, at least in the house of representatives of which he is a member, his opposition to it, he invites attention from its friends and advocates which the ordinary congressman would not receive. In the case in point on last Friday Mr. Burton announced in an interview published in the *Washington Post* his unalterable opposition to the shipping bill, saying, "I am against the bill, as I always have been, and will oppose it as vigorously as I can."

The attention of Senator Gallinger was called to the above quoted statement upon his arrival in Washington on the day of its publication, and he was asked if he had any comment. He did. And his comment was equally as explicit as that of Congressman Burton's. He pointed to the fact that Mr. Burton, as chairman of the rivers and harbors committee of the house of representatives, was seeking to secure the passage of a river and harbor improvement bill involving the expenditure of about $75,000,000, a measure that would have to run the gauntlet of the senate committee on commerce which favorably reported the shipping bill that passed the senate last winter. That in that committee the proposed river and harbor improvement bill would receive the closest scrutiny. Announcing himself as a friend of river and harbor improvement, Senator Gallinger, who is a member of the senate commerce committee, stated that "there is no logical reason why we should continue to spend hundreds of millions of dollars on our rivers and harbors, largely for the benefit of foreign shipping interests, and refuse to appropriate a dollar for the rehabilitation of the American merchant marine." This serves notice upon Mr. Burton, and his friends, that if further large outlays are to be made for deepening our channels, American-built ships, protected against the subsidized foreign competition which has driven them from the seas, must be aided by our government to use them.

It was time that Mr. Burton realized that his committee on rivers and harbors is not "the whole thing," as one might imagine that it was from the frequency and extent of the space he as its chairman has received in the press. It is worth while to remember that that veteran champion of American shipping, Senator William P. Frye, is the chairman of the senate commerce committee, to which the river and harbor improvement bill is referred. With Senators Frye and Gallinger on watch, aided by the support and sympathy of the other members of the senate commerce committee, it is quite time that the American side of river and harbor improvement was announced in order that it may receive due consideration. Senator Gallinger's statements will come as

a relief to the country at large, and prove to be most interesting reading, we doubt not, to Congressman Burton.

DEBATING SHIP SUBSIDIES.

In a circular issued by the state superintendent of public instruction of the state of Washington, addressed to the accredited high schools of the state, we learn that the subject of subsidizing our ships will be debated to a finish by the debating teams of each of the thirty-one high schools of that commonwealth. Following is the proposition: "Resolved, That the best and most practicable method of upbuilding the American merchant marine is the system of subsidies to American-built ships." On Dec. 15 the first debate begins. The winning teams must hereafter again debate the proposition with each other, until one team is triumphant. During the course of the debate it is expected that the winning teams may be compelled, a number of times, to take both the affirmative and the negative side of the question. A public-spirited citizen, whose name is not announced, has offered a prize of $100 for the best debating team, and another prize of $50 for the best debater, in the contest. The committee in charge of the contests is Prof. A. R. Priest, of the State University, Prof. Charles Timblin, of the State College, and Prof. J. H. Morgan, of the Ellensburg normal school. Copies of the circular may be obtained by addressing Hon. R. B. Bryan, superintendent of public instruction, Olympia, Wash.

Doubtless these debates have been stimulated by the offers of the Merchant Marine League, of Cleveland, O., of $1,000 in four prizes for the four best essays on how to build up our shipping in the foreign trade. League officials inform us that the demand for literature and documents from the state of Washington is unprecedented. A few weeks ago we stated that the entire class in economics in one of the state colleges were contestants for the Merchant Marine League's prizes, and now the entire state's high schools are to discuss the subject to a finality that should leave but little to be said.

We confidently predict the victorious affirmation of the proposition.

FREIGHT SITUATION.

The lake season is closing practically featureless. Weather conditions moderated at upper lake ports during the early part of the week, making the loading of ore somewhat easier than last week. Owing to the domination of the contract system the ore rate has remained practically stationary throughout the season and there is little doubt but that the rate of 75 cents from the head of the lakes, 70 cents from Marquette and 60 cents from Escanaba will be the prevailing rate next year. In fact, some shippers have already closed their business for next year upon that basis and undoubtedly before the year is out all the leading shippers will have entered into contracts.

The ore shipments for November were 3,734,107 tons, making the total movement up to Dec. 1, 36,073,002 tons. As this is only a few cargoes short of the 37,000,000-ton mark, the total shipments for the year will probably be about 37,300,000 tons. With the all-rail shipments added, the total movement may reach 38,000,000 tons.

Coal rates for the first week in December were advanced 10 cents to the head of the lakes. The grain trade advanced to 2 cents, but the amount available is not large. Following are the grain shipments from Duluth last week:

	Receipts.		Shipments.	
	Dec. 1.	Nov. 24.	Dec. 1.	Nov. 24.
Wheat	2,246,364	2,060,765	2,672,592	2,020,897
Corn	.....	.....	.....	.....
Oats	68,975	6,737	176,533	94,950
Barley	488,524	548,748	741,200	923,222
Rye	18,420	16,839	.....	28,349
Flax	1,304,985	106,840	734,450	1,557,365

MARINE INSURANCE SEASON.

According to one of the most prominent marine underwriters, the lake business this past season has been a losing one. For one cause or another, he says, the vesselmen have looked to the underwriters to pay for everything, and the natural result is that this has been the case since the Zimmerman-Saxona collision right down to the loss of the Theano, the sinking of which means another $150,000 in the loss column.

The heavy losses have been added to by the abrogation of the insurance clause known as the "deductible average." Where there was an incentive before to keep vessels off the bottom and out of harm's reach, the knowledge that the boats would not have to pay for any part of the damage has had a demoralizing effect. At least this is what may be inferred from the talk of the underwriters.

Just how the insurance men abrogated the deductible average is an interesting story, the main feature of which is hard competition. It appears that the foreign companies led the van by doing away with the clause, and in order to get a fair share of the business, it seems that the domestic companies had to follow suit or get lost in the race for business. But this is only one feature.

According to the underwriters, the deductible average was the best safeguard the vesselman has ever had, principally because the boats are not insured against loss of time while in dry docks; with the average to think of, extraordinary care would be used in operating a boat when slight damages would necessarily come out of the boat itself, without it, the underwriters say; but the profits of a season are eaten into when a boat is docked, even though the wear and tear on the boat is paid from the insurance, as does not always happen when the crew is shown to have been overzealous.

That the owners have reached the limit in size is the firm opinion of many of the marine insurance men. For this reason, it is stated the next evolution will be a thorough study of permanency, durability, safety in construction and skill in management. Experience along these new lines, it is declared, may show the owners that the present leviathans are not needed, that they are really too big. It may also result in bringing the business back to its normal state.

Just what causes so many accidents the underwriters are not prepared to state, but it is a significant fact that one man in figuring over collisions, said he could not recall any instance where boats came together from any unavoidable cause. Urging its force strongly, this same man declared the late W. B. Robinson, supervising inspector, spoke truly when he said captains should be punished by imprisonment instead of loss of their license when avoidable collisions occur.

An overamount of zeal to outdo the other fellow is acknowledged to be the cause for numerous accidents, and so long as the underwriter pays, there has never been much worry. The captains say they are not to blame because their owners haul them over the coals if they do not make fast time and keep even with the other fellows, or more often ahead of them. But the underwriter says this is poor policy, because boat property rapidly depreciates and should be protected on the theory that it is more valuable when in operation than in dry dock or at the bottom of the lake. In thinking of their immediate benefit, the vesselmen lose sight of their prospective disadvantage.

"In The Merchant Service."

Fire-and-boat drill was over on the Hamilton, and the crew had dismissed to their quarters.

The engineers had foregathered in the Third's room, and were sprawling about in the usual attitude of reckless abandon, which denotes the fact that the owner of the room is busy elsewhere. The Third was having seven-bell lunch.

LINED UP.

They were discussing in a leisurely manner the late drill, each man having some caustic remarks to make on the various crews of their numerous boats—barring his own, of course.

It was no occasion for the characteristic argument, so, when the Second smiled reminiscently, and displayed other symptoms of having another of his yarns to spin, he found an attentive audience.

"Talking about fire-drills," he commenced, "I will never forget the first fire-drill it was my painful duty to take part in.

"I was on the old East Indian at the time, and fire-drills were just coming into force.

"Our skipper, a very dignified little man, not long in command, hailed with delight the order from the office to have fire-and-boat drill every Sunday morning at sea—weather permitting, of course.

"He intended making an event of it.

"Well, we sailed in due course, and the eventful Sunday arrived, bringing with it all sorts of preparations for the successful carrying through of the drill at ten o'clock.

"The Third, Graham, was on watch at that time, so I had the task of rounding up the boiler-room gang to muster. Our 'Old Man' had a preliminary inspection down in the fo'castle, and a motley bunch our crowd looked when lined up.

"The company hadn't raised the firemen to the dignity of a uniform then, so they had rigged themselves out in the best their kits contained. All sorts of jumpers, guernseys, and caps were on parade, and a more piratical looking crew never shipped across the 'Western.' I guess they must have had a tarpaulin muster, on a share-and-share alike basis.

"Some little time before the drill came off, Graham made the necessary preparations below, opening up the usual deck connections on the pump.

"I say *the* pump, as we were not so lavishly provided with pumps then as we are today, and our donkey had to fill the bill as sanitary, bilge or deck pump as occasion required.

"Now, after setting the pump all ready for action, Graham went out to the fire room to hustle along the already hustling watch. Perhaps he was a couple of points behind—he usually was.

"But the Junior on watch, Brown, was having trouble with his bilges, and, fearing the gradual accumulation of water in his wells, *he* set the pump ready for bilge work, if necessary.

"Thereby hangs a tale.

"The passengers got wind of the fact that a muster was coming off, and had collected on the promenade deck under the bridge, prepared to take a lively interest in the proceedings. Any break in the monotony of the trip was welcome.

"Below on the main deck, the sailors were lined up with a couple of hoses, our gang manning the geared pumps on deck.

"Under the fo'castle head, the doctor and some of the other auxiliaries had their quarters, and when their doors were closed, a large expanse of beautiful white bulkhead was exposed to view. Against this bulkhead it was decided to play the hoses, for effect, you understand.

"When the eventful moment arrived, the stewards appeared on deck armed with fire hatchets and buckets, and a 'hush of expectancy fell on the throng.'

"Suddenly the alarm bell rang out—away down below could be heard the tinkle of the telegraph, and immediately after the faint beat of the fire pump.

"'Here she comes,' sang out the bo'sun's mate. The sailors took a deep breath and a firmer grip. The hoses squirmed and stiffened out as the water arrived—a magnificent flow of muddy-brown bilge extract, interspersed with portions of grease and coal dirt.

"If I remember rightly, there was also a smell.

"For a few seconds everyone just gaped, till the spell was broken by the bo'sun's mate dropping the nozzle of the hose. His action was followed with great promptitude by the sailors supporting him in the rear.

"The hose on hitting the deck took charge, and proceeded to deliver a 30-ft. stream of bilge water to all the points of the compass in as many seconds.

"Some of the more daring deck hands tried to regain possession of the nozzle by stealthily pouncing on it from the rear, but the hose was having the time of its life and absolutely refused to be knelt on.

"The other hose, meanwhile, was hoisted over the rail and allowed to waste its sweetness on the nautical desert air.

"The Chief, just as soon as he recovered from his surprise, started aft in a kind of dignified hurry to where the old pump was getting in its deadly work. I stayed behind to keep a wary eye on our gang, as their expressions of deep melancholy foretold the preliminary canter of their risible faculties.

"Diving through the engine-room door, the 'old man' leant over the rail, and shaking his fist at Graham, who was peering up through the gratings from below, yelled in a voice choked with emotion for the pump to be stopped.

"Graham, seeing his violent gesticulations, and not having received the prearranged signal to stop the pump naturally enough concluded that more pressure was wanted on the hose.

"Running round to the back of the engine room, he gave the old pump full steam and 'let 'er rip.'

"Then the Chief, having seen the Third run round to the pump, hurried forward again, panting with the unusual exertion.

"Instead of finding the trouble past, as he expected, he found the passengers and crew watching from various places of refuge the efforts of a solitary sailor trying to drag the writhing hose to the rail.

"He gave one gasp and stopped short on the deck, and I am also afraid he said 'damn.'

"Then I started off to the engine room through the flying spray. When I reached the starting platform I found Graham anxiously watching the pump, which was rocking back and forth with tremendous efforts, his hand on the steam valve. We shut her down and swapped explanations.

"On deck the hose gave a last dying wriggle, and straightened out flat on the deck. Its work was done.

"Then the passengers crept cautiously forth to gaze on the scene of devastation, and we chased our men, who were laughing uproariously, to their quarters.

"The sailors were turned to, to remove what traces they could of the bilge discharge from the bulkhead, rigging and deck.

"Of course, the Third appeared in due time 'on the carpet,' and the following facts were brought to light:

"As I told you the pump was originally set with sea suction and discharge to deck open. Brown altered it to bilge suction and discharge overboard, without mentioning the matter to Graham.

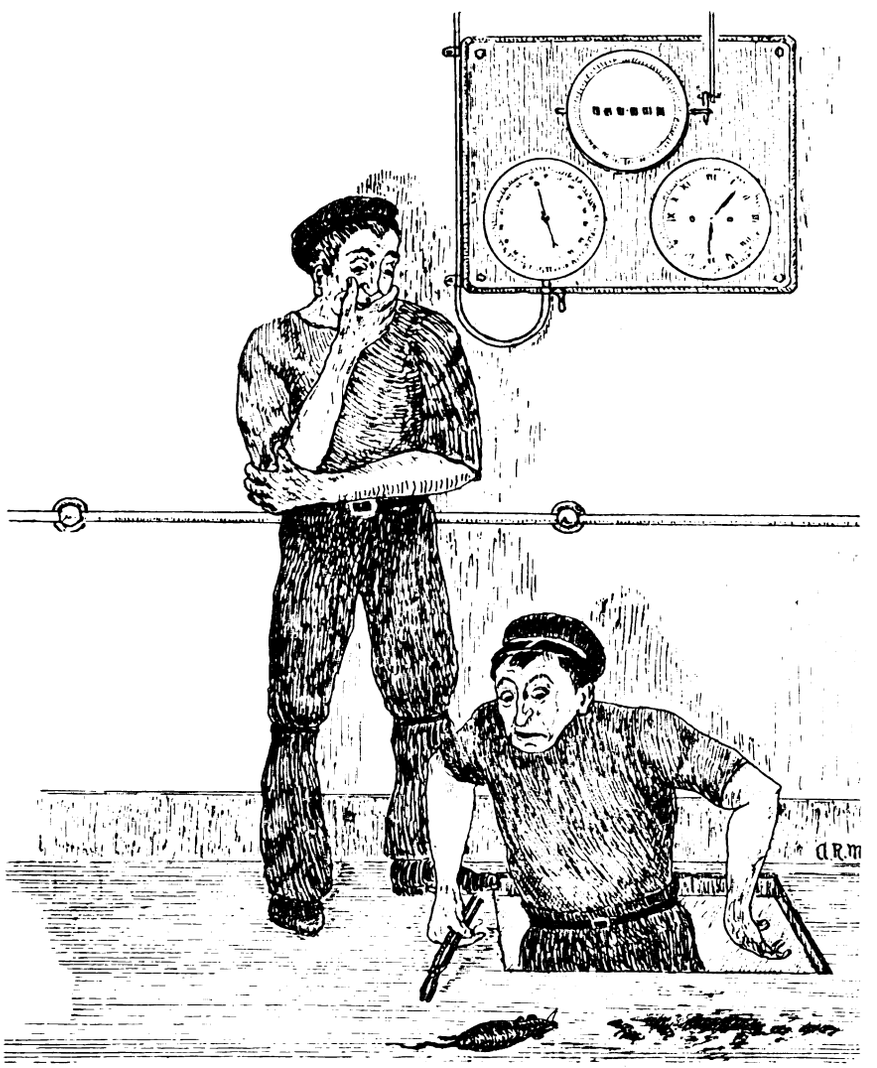
"Graham passing the pump a few minutes later noticed the discharge, and mildly astonished at his (as he thought) blunder set the discharge for the deck.

"Our first fire drill was a rank failure as a fire drill, but as a never-ending topic of conversation and unseemly jest it was a huge success.

"The following Sunday we had another trial, and this time pulled it off without a hitch. I am afraid that this fact rather annoyed the passengers, who had mustered in full force on the promenade deck, even to the lame and the halt.

"Probably they expected a repetition of the previous drill, at any rate they were doomed to disappointment.

"The skipper and the 'Old Man' had made up their minds that there would be no hitch this time, which in all likelihood accounted for the glare the skipper gave one jovial passenger who appeared on deck carrying a borrowed oilskin coat and a huge umbrella; the idea!" THE "STAND-BY" MAN.



TROUBLE WITH HIS BILGES.

METEOR AT SEA.

Chief Engineer A. R. Powell, of the Phoenix Liner St. Andrew in describing the meteor sighted at sea on their west-bound voyage said: "I was on deck at sunset, standing abaft the engine room, when the meteor was sighted. There were two or three members of the crew in my vicinity at the time, one of them drawing my attention to the 'stream of fire,' as he called it.

"It was falling with great velocity, and by the erratic course of the tail of fire in its wake was probably disc shaped. I can only guess at it's tremendous size by the commotion made on plunging into the sea, when it took the water about a mile and a half off our port beam. Of course, if it had been nearer, I would have been better able to judge, but it was quite near enough to satisfy any curiosity I might have had on the matter."

AROUND THE GREAT LAKES.

The Detroit & Cleveland line declared the usual semi-annual dividend of four per cent, payable Dec. 15.

The Canadian steamer Turret Crown missed the harbor of refuge in the storm at Grand Marais last week and went on the beach.

The harbor committee at Holland, Mich., has inspected the piers since the last severe storm and find that a new north pier is necessary.

The Toledo Ship Building Co. will repair the vessels Simon J. Murphy and the Harvard, of the Pittsburg Steamship Co.'s fleet, during the winter.

The directors of the Detroit & Buffalo Steamboat Co. have declared a dividend of five per cent, payable Dec. 15, making eight per cent for the year.

The steamer Tecumseh, released from the south passage Lake Erie by the tug Home Rule, is at the Ecorse yard of the Great Lakes Engineering Works for repairs.

The schooner Queen of the Lakes, owned by Richardson & Son, Kingston, Ont., sunk opposite Sodus Point last week, the crew taking the small boats as she went down.

Capt. Harris Baker, of Detroit, who purchased the hulk of the steamer Fisk, which burned near Beldore's six weeks ago, will begin the work of recovering the wreck at once.

The steamer Conestoga, rebuilt at the Ecorse yard of the Great Lakes Engineering Works for the Crosby Transportation Co., has left for Lake Michigan with a cargo of salt.

The steamer Mataafa, which was wrecked in the big November gale a year ago off Duluth, has been floated out of dry dock. She will not, however, go into commission this year.

The Great Lakes Towing Co. has succeeded in lightering the cargo of the wrecked steamer Conemaugh, ashore off Pelee island. The cargo of dry goods was valued at over $50,000.

Capt. James Davidson has announced that the steamer Panama which was driven ashore near Ontonagon about a week ago has been abandoned as a total loss. She carried no insurance.

The steamer Northern Queen, bound for Duluth with a cargo of general merchandise, ran on Point Abbey during a heavy storm. Her forward compartments are reported full of water.

Several well known mariners got together in Buffalo recently and organized a new society which will exist during the time that they lay up their boats. The headquarters is to be known as "Grand Marais."

The steamer Chisholm was released from the bank near the county building at Houghton after 30,000 bu. of her cargo of grain had been lightered. Later the grain was reloaded upon her, as she had not been damaged.

Capt. Cyrus H. Sinclair, representative of the underwriters, has returned from the wreck of the Conemaugh on Pelee island, and is of the opinion that the boat can be floated and saved if the work is done right away.

While the stern of the car ferry Ashtabula was raised so that repairs could be made to her propeller wheel, several cars loaded with coal broke from their fastenings and did considerable damage at the forward end of the boat.

The Port Huron Contracting Co., Port Huron, Mich., successors to the Port Huron Ship Building Co., is reported as about ready to resume operations at the old yards on Black river and will build dredge hulls.

The two steamers building at the Bay City yard of the American Ship Building Co. for the Gilchrist Transportation Co., of Cleveland, will be named after Gen. George Garretson and Henry P. McIntosh. The Garretson will be launched on Dec. 22.

While bound from Ludington to Manistee, the rudder chain of the steamer Pere Marquette No. 6 parted when the ship was abreast of Point Sable and she narrowly escaped running on the beach. She was taken to Ludington for repairs by the aid of a hand steering gear.

The crew of the steamer J. L. Weeks re-christened her at Buffalo about ten days ago, giving her the euphonious name of "Two Weeks." The reason for this was that the boat was held in port for about two weeks at the American Malting Co.'s new plant above the Ohio street bridge.

President Livingstone, of the Lake Carriers' Association, has received a dispatch from the Canadian minister of marine at Ottawa stating that the wishes of the Lake Carriers in respect to the Bar Point gas buoy will be complied with and the buoy will be allowed to remain until the boats stop running.

Twenty loaded freight cars broke loose from their fastenings on the Ann Arbor car ferry No. 1 this week while the ship was being tossed in heavy seas. The crew had hard work to keep the cars from being dumped into the lake, and as it was several thousand dollars worth of damage was done. The car ferry was bound from Manitowoc to Franklin.

A meeting of masters of lake vessels was held in the Duluth office of the Pittsburg Steamship Co. on Monday last to discuss aids to navigation with a view to reporting such suggestions as they might agree upon to the Lake Carriers' Association. Their recommendations will be embodied in a report which the Lake Carriers' Association will make to the general government.

The dredge constructed for the Empire Engineering Co., of New York, by the Manitowoc Dry Dock Co., Manitowoc, Wis., is enroute to its destination in tow of the steamer Parks Foster. A stop was made at Detroit to pump out water which had found its way into its hold, owing to the heavy sea encountered in Lake Michigan. She will be taken apart for towage through the Erie canal.

The tug James R. Sinclair was launched from the repair yard of the Great Lakes Towing Co. on the Chicago river on Saturday last and was marked by two unusual events, the first that she was launched stern first instead of sideways, as is the ordinary custom on the lakes, and the second that she was christened by a man. It was intended to have Mrs. Sinclair name the new boat, but owing to illness the tug was named by her son, Cyrus H. Sinclair. The tug is 68 ft. long, 17½ ft. beam and 11½ ft. deep. She is the first steel craft ever to be built on the Chicago river.

The steamer George W. Peavey, which became disabled in the Detroit river, reached Buffalo recently and was taken in tow by two Great Lakes tugs. She will be put in No. 1 dock at the plant of the Buffalo Dry Dock Co. There is not much time left in which to make repairs, but it is safe to say that she will undoubtedly be rushed for another cargo, at least. The dry dock company is making quite a reputation for itself in this respect. John A. Weisbeck will represent the owners in the survey to be held on the Peavey when she is put in dock.

That the entrance to the harbor of Duluth is unsatisfactory from the vessel standpoint was again emphasized last week when the Anchor liner Susquehanna struck the bottom in the heavy sea that was running. Her stern struck the bottom in the trough of one of the big waves just as she was fairly between the piers and as a result control was lost for a very brief time, during which she hit the south pier with her stern and later the north pier with her bow. Fortunately the Susquehanna was not appreciably injured, but the incident was potential in revealing the possibilities of grave danger. Mr. Harry Coulby, president of the Pittsburg Steamship Co., happened to be in Duluth at the time and declared that the Duluth ship canal ought to be closed and a wider and more centrally located one cut through Minnesota Point with a V-shaped breakwater inside the bay.

The two lake-built steamers Minnetonka and Minnewaska, which were bought in by the American Ship Build-

ing Co. from the American Steamship Co., for whom they were originally built, and which were sold by Mr. J. C. Wallace, of the American Ship Building Co., to the United Steamship Co., of San Francisco, organized by Arthur Hill, of Saginaw, and James Jerome, of San Francisco, have been renamed Santa Maria and Santa Reta. They were built on the lakes for salt water service and were towed through the Canadian canals in two sections. After they were sold to the United Steamship Co. they were remodeled at Newport News into oil tank steamers and were chartered to the Union Oil Co., of San Francisco, for a period of ten years to carry oil to the Panama canal. The interesting point about these two steamers at present is that the Detroit Trust Co. is trustee for an issue of $200,000 worth of bonds upon these steamers. The issue is well secured, however, as it is understood that the earnings under the charter will amply repay both principal and interest and yield a satisfactory dividend as well to the stockholders of the steamship company.

NAVIGATION OF STEAM VESSELS.

United Harbor No. 1, American Association of Masters, Mates and Pilots, held open meetings at the Teutonia Assembly rooms, New York city, on the afternoon of Monday, Nov. 12, 1906, and evening of Tuesday 13th inst. The object of the meetings was to discuss the laws governing the navigation of steam vessels and explain the difference between the construction placed on the laws by the steamboat inspection service, and the customs followed by licensed officers in the navigation of their vessels, and make recommendations, if possible, for amendments to the different laws governing the navigation of steam vessels. It was also hoped that these meetings would promote a more friendly feeling between the licensed officers, superintendents, and owners. The meetings were well attended, there being a large muster of association men. There were also several owners and superintendents interested in the work of the association, among the audience.

The meeting room was decorated with the great flag and bunting of the association, and at intervals an excellent musical program was discussed, the utmost good feeling prevailing.

Mr. Irvine B. Grace and Capt. Luther B. Dow were in the chair. Capt. John C. Sylvia, president of the association, gave a brief history of the organization, spoke on the duties of the licensed officer, and said a few words in praise of the local steamboat inspection service. Captain Luther B. Dow, general manager of the association, spoke at some length on the increasing traffic in the harbor of New York, and the difficulties experienced in endeavoring to follow out the rules under certain circumstances. Some of these rules, made law by congress when steam-boating was still in its infancy, are impracticable now, and particularly so in the busy harbor of New York. On the great lakes at present, they have certain benefits denied the sea ports.

Supervising Inspector General George Uhler gave a brief history of the laws governing the navigation of steam vessels, and the introduction of the bells, lights, and steam whistles system of signaling. He spoke of the tremendous traffic on the great lakes, and the increase in the number and size of ships there in the last five years. There, also, they are having increasing difficulty in endeavoring to abide by the rules laid down in bygone years, when ships were small and fewer of them.

Mr. U. Irvine Coones spoke briefly on shipping and commercial interests coming under his notice as a marine underwriter, his experience dating back to the old fast clippers and wooden-hulled steam boats.

Capt. Ira Harris read a paper of general interest to the members and visitors, and advised licensed officers that it is better to endeavor to live up to the existing rules than have none. He spoke in praise of the good work of the association, saying that the value of these meetings was recognized by the secretary of the department of commerce and labor.

Mr. N. L. Cullen, vice president, spoke on the good work accomplished by the association since its commencement, and advised the continuance of the good feeling among licensed officers in the performance of their duties in the harbor of New York.

Captain H. O. Nicholson, marine superintendent, spoke briefly to members on the rules of the road.

One of the events of the evening meeting was the presentation of a magnificent loving cup to Captain Dow, as a token of the deep regard and brotherly love of United Harbor No. 1.

BATTLESHIP BUILT IN JAPAN.

Tokio, Nov. 15.—The first-class battleship Satsuma was launched today in the presence of the emperor. The greatest enthusiasm was manifested. The newspapers here reflect the epoch-making nature of the event, as indicated by the unprecedented presence of the emperor, and eulogize the success of the naval constructors. It is taken for granted that the vessel is the equal of and perhaps superior to anything afloat.

The keel of the Satsuma was laid on May 15, 1905, so that she has taken a good deal longer to build than the British Dreadnought. The greatest secrecy has been maintained in regard to this, the largest battleship in the world. Japan did not even admit that a battleship was being built in a Japanese yard, though it is now known that another vessel like the Satsuma is in course of construction, and that two even larger vessels are planned.

According to unofficial reports the Satsuma is 482 ft. long, has 83½ ft. beam, and has a tonnage of 19,200. The tonnage of the Dreadnought is 18,000, but the British battleship is 500 ft. long.

The armament of the Satsuma is to consist of four 12-in. guns, twelve 10-in. guns and twelve 4.7-in. guns. She is to have a speed of nineteen knots. The Dreadnought carries ten 12-in. guns.

The Satsuma is the first battleship built in Japan. Various lessons learned in the recent war have been utilized in her construction. She was built by Japanese labor exclusively.

ARMORED CRUISER CALIFORNIA'S TRIAL.

San Francisco, Nov. 18.—Sirens on the new armored cruiser California sounded all the way along the water front as the fine vessel was returning from her official government trial at sea, announcing that the warship had made a record worth talking about. The California went direct to an anchorage off the Union Iron Works. She had left the spot soon after 8 o'clock in the morning, proceeding to sea and taking a course that extended perhaps forty miles to the westward.

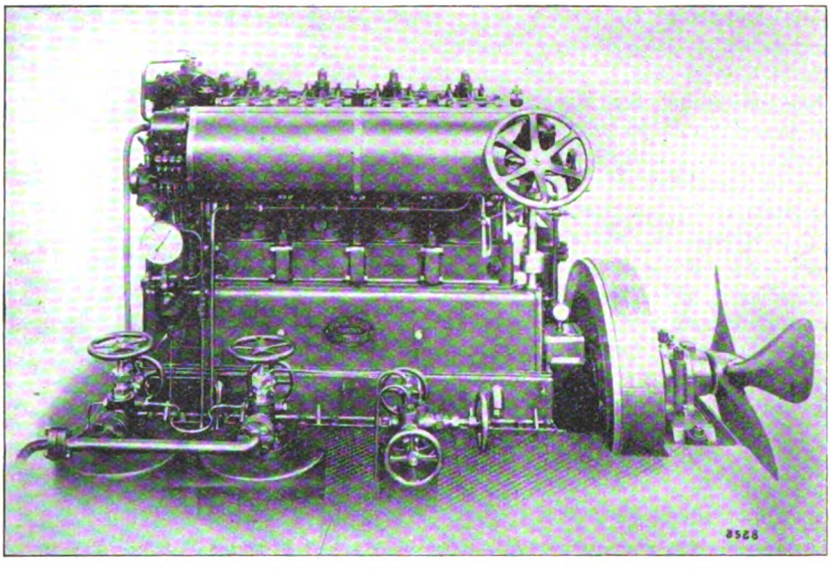
The California was required to make an average of 22 knots an hour for four hours. She did better than this, having averaged 22.22 knots. The highest speed attained was 22.32, and this was kept up for a period of fifteen minutes during the run. A heavy swell prevailed, which probably prevented the cruiser reaching a higher mark of speed. But her average of 22.22 is nearly a quarter of a knot better than is required, and places the California in the class of very sucessful armored cruisers.

Fred A. Gardner, chief engineer of the Union Iron Works, who was on board during the run, expressed himself as highly pleased with the vessel. There were no accidents during the trial and the machinery worked perfectly.

THE SULZER-DIESEL REVERSIBLE COMBUSTION MARINE ENGINE.

We here give an illustration of the reversible Sulzer-Diesel marine engine of 100 H. P. exhibited in the section for marine and river transports of the Milan Exhibition, 1906. The excellent results which have been obtained with stationary internal combustion engines have made it desirable to introduce same for ship propulsion purposes. Typical marine engines with the propeller direct-coupled to the engine and which can be reversed and controlled like a marine steam engine have, however, so far not been heard of. Further, the combustion engines are far ahead of the steam engines with regard to fuel consumption. For the same output the weight of fuel is, in the case of gas and oil engines, one-third to one-half, and in the case of the Diesel engines one-fourth to one-sixth of what it would be for steam engines. The combustion of the fuel in the cylinders of internal combustion engines can be made so complete that the exhaust gases are practically invisible, a great point, especially for the navy, where the smoke when running the steam engine under heavy overloads must be considered as a great disadvantage. A further advantage is the easy and speedy way in which the liquid fuel can be taken on board by means of centrifugal pumps or compressed air, likewise the transport from the tanks to the engines by the same means is as simple and clean as possible. The liquid fuel can be stored in ballast tanks or between double bottoms. Besides the reduction in weight and space required for the liquid fuel as against coal, the weight taken up by the machinery is considerably less, owing to the absence of boilers and gas producers. The engine room may thus be one-third smaller than for steam plants. Again, when the engine does not work, no stand-by losses need be taken into account.

Among the oil engines it is claimed that the Diesel engine excels by using heavy and cheap mineral oils or residues which cannot be utilized in other engines. The liquid fuel is supplied directly by the combustion cylinder, where it is ignited by means of highly compressed air of high temperature. The quantity of fuel required to give a certain output can be exactly regulated, which is not the case with suction gas plants. If the fuel supply to the cylinder has once been adjusted, it is quite independent of the engine driver, and in no way affected by the temperature of a gas producer or a carburetter.



SULZER-DIESEL REVERSIBLE COMBUSTION MARINE ENGINE.

The reliability of the ignition is ensured through the compression taking place regularly in the working cylinder itself, whereas in the internal combustion engines it is effected by means of electrical or tube ignition. Further, there is no sudden increase of pressure during the ignition period; the combustion takes place at constant pressure, and as the compressed air and liquid fuel are taken to the cylinders separately premature ignition is avoided and the reliability of the engine considerably increased. The flashing point of the Diesel engine fuel is so high that danger from explosion or fire need not be taken into consideration, nor are there any poisonous gases, as, for instance, in the case of gas producers. Again, the combustion in the Diesel engine is so complete that it is not necessary to examine the cylinders, pistons and valves. There are said to be Diesel engines, which under varying loads have been working for weeks without stopping, and with the even loads under which marine engines work no difficulty is expected from this quarter.

One great advantage of the Diesel engine is its constant readiness. It can easily be started up in two or three minutes without any preliminary manipulations being required.

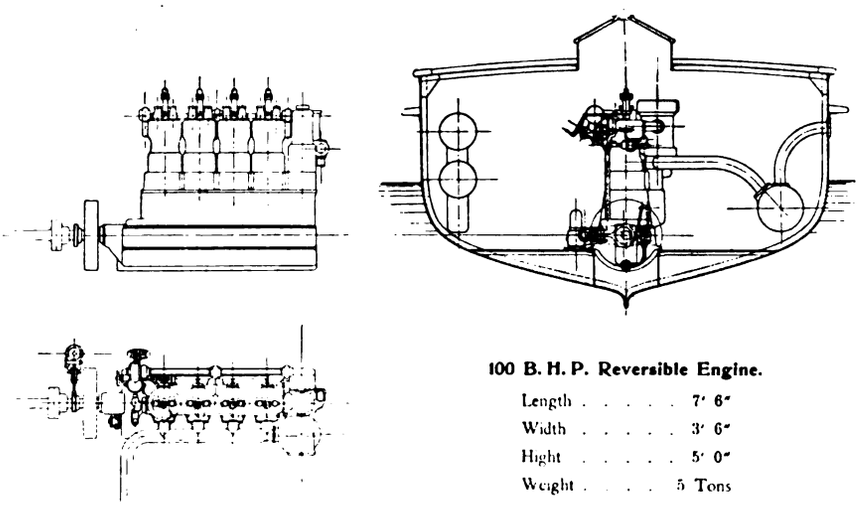
So far the Diesel engine has mostly been built as a four-stroke engine, consequently its cylinder dimensions are considerably larger than those of a double acting steam engine of the same output. The comparison does, however, not come out quite as unfavorable for the Diesel engine as at first sight one might be led to believe. The average indicated pressure in the Diesel engine is about twice as high as in a modern steam engine, and even taking into consideration the ten or twelve per cent higher efficiency of the double acting steam engine (against the four-stroke engine) the average effective pressures are still higher for the latter (1.8 against 1). For the same speeds the respective cylinder volumes work out at 1 : $\frac{4}{1.8}$ = about 1 : 2¼.

The Diesel engine can be built on the two-stroke principle and does not in any way imply reduced thermal or mechanical efficiency. Its cylinder volume is only about ten or fifteen per cent larger than for steam engines of the same output. Of course, the weight of the flywheel of the internal combustion engine must be added, but this, again, is considerably smaller for the two than for the four-stroke engine.

The dimensions of the connecting rod, the shaft and frames are greater for Diesel engines than for steam engines, the combustion pressure being higher than the corresponding initial steam pressure. But even allowing for this, as well as for the weights of the injection and starting vessels, the total weight of the Diesel engine equipment is considerably smaller, owing to the absence of the condensing and boiler plant, feed pumps, forced draft, and ash hoisting devices. In ships of the same dimensions and speed when driven by Diesel engines the advantages are: (1) reduction in the weight of machinery; (2) reduction in the weight of fuel; (3) reduction in the size of the engine room and tank rooms. The result is that ships can be built with finer lines, which, again, reduces the output required of the engines, or gives the ship a higher speed with lesser weight of the tanks, and with higher speed the radius of action can be considerably increased.

To fully utilize all the above advantages, it is necessary to build the Diesel engines on similar lines as marine steam engines, that is to say, it must be made

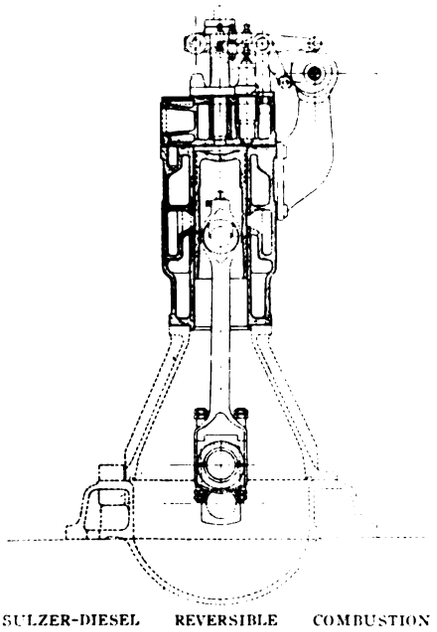
reversible. With a few exceptions nearly all gas and oil engines hitherto used for driving ships were of the non-reversible type, working in connection with a reversing clutch or reversing propellers; the few reversible engines, mostly of the four-cycle type, which have been brought upon the market, had to be provided with six to eight cylinders, all working on one crank shaft, or with a reversible auxiliary pump or similar devices. The reversible engines require to be uncoupled before reversing, and to be recoupled after the reversion has taken place, as they cannot start under considerable load. The disadvantages connected with the above mentioned systems render it impossible to use same when dealing with large powers, so, for instance, uncoupling the propeller by means of the friction clutch when reversing may cause the engines to race, so endangering the engine itself. The uncoupling, together with the reversing motion, further, requires a comparatively long time, and the propeller itself is not under the driver's control during this time. The transmission of power through friction couplings is not always reliable, and it is out of the question for larger engines and the same applies to reversible propellers. The new reversible Sulzer-Diesel marine engine works on a similar principle as the original Diesel engine and is a reversible two-stroke engine. The reversing devices are of very simple and reliable design, as the two-stroke principle allows of reversing the starting and fuel valve only, and does not necessitate the reversing of other parts. As a rule the engines consist of four cylinders, thus ensuring great reliability in starting, and at the same time an even turning movement. The flywheel is very much lighter than for other internal combustion engines hitherto used for ship propulsion purposes.



100 B. H. P. Reversible Engine.

Length	7' 6"
Width	3' 6"
Hight	5' 0"
Weight	5 Tons

SULZER-DIESEL REVERSIBLE COMBUSTION MARINE ENGINE.



SULZER-DIESEL REVERSIBLE COMBUSTION MARINE ENGINE.

The Sulzer-Diesel marine engine can be built up to 1,000 and more B. H. P. and recent tests on an engine of 100 B. H. P. show a fuel consumption which is only slightly higher than that of a four-stroke Diesel engine. The makers are Messrs. Sulzer Brothers, engineers, Winterthur, Switzerland.

Cargo handling is one of the specialties on the great lakes, especially as concerns bulk freight. Recently at the Mare Island navy yard, however, with a Brown hoist using the one-ton tub, 4'9 tons were discharged from the French ship Biarritz, loaded with Cardiff coal, in nine hours. Every tenth tub was weighed. The drop was 208 ft. from the ship's hatch. To handle the 419 tons, 438 hoists were made.

QUALIFICATIONS OF MARINE ENGINEERS.

The board of trade, says the Glasgow Herald, have under consideration at the present time suggestions which they have solicited from some of our engineering associations regarding the provisions of a new bill to regulate the certificates of competency of sea-going engineers. It is a general recommendation that qualifications for a third-class certificate should be stated in the bill, and that first or second class engineers should have served an apprenticeship of a nature previously set forth. The third class certificate as engineman should be granted after service at sea of not less than two years as stoker, and not less than two years as greaser or donkeyman; and a good general knowledge of the working of engines and boilers should be shown by means of examination. A certificated engineman should not be eligible for a certificate as first or second engineer unless he had served a proper apprenticeship, a scheme for which had been submitted to the board of trade by the consultative committee. It was also recommended that steamships below 100 nominal horse power should carry at least one first class or second class engineer or a certified engineman. Finally, it is proposed that engineers or enginemen who contribute to breakdown at sea should have their certificates dealt with as severely as are those of deck officers under corresponding circumstances.

THE NEW EXPRESS CUNARDERS.

Although the great turbine Cunarders, the Lusitania and Mauretania, are in general respects sister ships, there are some points in which they differ. These have to some extent a bearing on the all-important question of speed. The Mauretania is six inches deeper in her draught, and some seven tons longer in her gross tonnage than the Lusitania. Messrs. Swan, Hunter & Wigham Richardson, the Tyne builders, and John Brown & Co., Clydebank, have taken different lines in regard to the shape of the stern and the dimensions of the propellers. Further, the stem of the Mauretania differs in some material way in shape from the Lusitania. The propellers of the Mauretania are further apart longitudinally, and the discs overlaps a little, while there is no overlapping in the Lusitania. A good deal of importance is attached to these points by architects, and the results will be interesting to note at the time of the trials.

SEEN AND HEARD IN THE ENGINE ROOM.

The steam yacht Psheclair was on her way down the bay toward the measured course between Scotland light and Fire island for the builders' speed trial trip.

Inquisitive readers are hereby incidentally advised that the yacht's unusual name does not appear in any dictionary of mythology.

Psheclair is simply a combination of part of the names of the owner's wife and daughter.

Upon arriving at the place whence the start is to be made, a gang of picked firemen immediately fill the furnaces (almost up to the crown sheets) with picked coal.

Large fans situated in the upper part of the fire room are then set in motion—an exceedingly rapid motion.

These whirling fans produce the forced draft in this air tight fire room.

The Psheclair carries tubular boilers; the kind in which steam is very readily made. But also, perhaps on the principle of "easy come, easy go," in these boilers the steam is wont to drop on the slightest pretext—or no pretext at all.

It was for this reason that the wily engineers had given instructions to the firemen to so "fix" the fires that they should not need an addition of fuel during the trial trip—or, in other words, arrange it so that the fire doors need not be opened while the run is made. Under the boilers, then, at the commencement of the trial trip, was a substantial body of live fuel, and on top of this as much "green," picked hard coal as could possibly be crowded in by expert shovelers. The forced draft did the rest, and the firemen were not in the least inconvenienced by the unusual pressure to which their bodies were subjected. Not a shovel was touched, nor a door opened, and when, at the conclusion of the successful trial, the Psheclair's head was pointed for the Narrows there remained yet sufficient "body" to the fires under her boilers to make the steam necessary for leisurely jogging to the mooring.

Some one defined "charity" as "the egotism of the altruistic." An egotism of the altruistic is now the term applied to the municipal ferryboats running between New York City and Staten Island. Says the New York *Tribune* of Nov. 28—(in the news columns)—"the ferryboats have been running at top speed since the service was inaugurated, and the heavy pressure under which they have been driven has caused defects in their boilers, condensers and engines to develop."

In short, last year's bill for repairs was $100,000.

That is a great deal of money; in fact, it is such a large sum that the *Tribune* of the same date, Nov. 28, deems fit to say something editorially anent this matter.

The editor has presumably interviewed some one, been told that the condenser tubes leak—and:

"All we are told is that the salt water in the condensing pipes leaks into the boilers, where it creates an excess of steam."

Thus, acording too the *Tribune's* editor, being "circulation water," as it is called, leaking into a boiler is conducive to increasing the steam pressure.

Said a South ferry engineer when shown the above editorial comment: "The *Tribune's* engineer must save lots of coal if he can substitute salt water drippings for high priced black diamonds." F. H.

THE HEATHEN CHINEE.

The chief engineer and staff of the steamer Montrose which arrived in New York from the far east, had a new brand of trouble to face in handling their Chinese crew on their voyage here. One of the officers brought aboard at Yokohama, a curio in the shape of a stuffed fish mounted on a stand. A human papier mache head, fearful and wonderful to behold, had been cunningly attached to the body thereof, the stand being mounted to ornament the mess room.

The "heathen Chinee" soon decided that the souvenir was an "evil joss" and would not have it on the ship at any price, demanding to have it thrown overboard, and absolutely refusing to work their fires. It was only the ship getting into heavy weather saved the situation, as the men preferred taking their chances with the joss to joining Davy Jones in his locker, but a new crew had to be signed in at the next port of call.

MARINE PATENTS.

Copies of these patents can be obtained by sending ten cents in stamps to Siggers & Siggers, patent lawyers, Suite 11, National Union Building, Washington, D. C.

836,543. Auxiliary Rudder. William M. Taylor, Mecklenburg county, Va.

836,524. Pneumatic Life-Saving Suit. Edward Morrell, San Quentin, Cal.

836,627. Means for Securing Logs in Rafts. Michael F. Brown, Seattle, Wash.

836,724. Ship's Progress Indicator. Thomas Whittle, Parhran, and William Cumming, Malvern, Victoria, Australia, assignors to said Whittle.

836,821. Boat and Propelling-Gear for Same. Gustaf Nelson, St. Louis Park, Minn.

836,892. Vessel Construction. Oswald S. Pulliam, Pittsburg, Pa.

THE POET AND THE TAR.

(Being a clash of soul and matter.)

THE POET.

"Oh, tell me, sailor, I pray,
Of the ocean sublime and blue,
Of the long, still nights,
When the Northern Lights
Do whatever it is they do.
Oh, tell of the radiant dawns;
Tell of Sitka and Singapore;
Of the creaking sails
And the spouting whales,
And the hurricane's fateful roar,
And the awesome thoughts in the sailor's mind
Whenever he leaves far, far behind
The lights of his native shore."

THE TAR.

"When I fust run away to sea
With a skipper called Mungo Noggs,
We wuz all of us full
From the Hook to Hull
Of the wariegatedest grogs—
And the mate was a sawed-off runt,
But the cook was a tallish chap,
Yet the rest of us b'ys
Wuz of average size
Though our whiskers—"

THE POET.

"Oh, tell me, sailor, I pray,
Of the ocean profound and vast;
Of the cloudless sky
And the seagull's cry
As it circles about the mast.
Oh, tell of the stinging spray;
Of the dangerous, dripping fog—
And infuse the whole
With a dash of soul,
For you sound like a vessel's log.
What I want is the salt sea tang—in brief,
Let your Inner Self be you Leit-Motif,
And do not allude to grog."

THE TAR.

"When I next sailed away to sea
For a skipper we had Zeb Tate.
Who, concealed by a fog,
So diluted our grog
That our jags wuz a whole day late,
And the cook, he wuz six foot two,
But his dog he wuz two foot six,
Yet the average size
Of the rest of us b'ys—
(Not countin' Pop Squid—wuz—
Wot's the matter, poet—wot in—
Leggo my throat!"

—Thomas R. Ybarra in the New York *Times*.

THE MAURETANIA.

(From an English newspaper, in Tyneside Dialect.)

At Waallsend thor's a greet big ship,
Myed by th' greet combine, man;
It beats them aall—just tyek ma tip—
A liner fast an' fine, man.
Its length is nigh eight-hundred feet,
Its speed thor's nyen afloat can beat,
It's champion o' th' Cunard fleet,
An' built upon th' Tyne, man.

She'll cary owre three-thoosand folks
Across th' briny main, man;
An' gan alang wi' pooerful strokes
Just like a railway train, man.
Nigh thorty-thoosand plates o' steel—
The figures myek wor poor heeds reel—
But it's a triumph aa can feel
Ov Tyneside hands an' brain, man.

Th' Garmans had th' fastest boat,
Until th' other day, man;
But when Waallsend gets hors afloat
She'll show them aall th' way, man.
Th' Kaiser haard, an' tworled his 'tache,
Said, "Gott in Himmel," blank an' dash—
"Dot ship ven launched vould make a splash,"
An' leukt quite far fra gay, man.

Ye see it gov him quite a shock,
An' he began te sweer, man;
Least what he said it wasn't "hoch,"
But soonded rethor queer, man.
We've knocked th' "Kaiser Wilhelm" oot;
It's "second" noo thor is ne doot—
In Potsdam they aall haard th' shoot
When Waallsend gov a cheer, man.

J. E. S.

Navigation on the Erie canal from Tonawanda closed for the season on Nov. 25.

QUESTIONS FOR MASTERS AND MATES.—NO. 21.

310. You are on the course from Eagle Harbor to Whitefish Pt. The weather is thick and you figure that you are about 10 miles from Whitefish Pt., but you cannot hear the whistle. How would you verify your position by soundings? What soundings should you get if you were to the eastward of your course; what soundings and which kind of bottom should you get if you were to the westward of your course?

311. Can one depend upon the bearings taken of a fog whistle in a heavy fog? Why?

312. Having obtained the bearing of a fog whistle during a fog how would you verify your position?

313. In a fog Whitefish Pt. fog whistle bears due south from you and you figure that you are 4 miles off, how would you verify it? Supposing your patent sounding machine gave your depth at 38 fathoms, how far north of the point are you?

314. In approaching a fog signal from windward where could you pick up the whistle earliest, aloft or on deck?

315. Approaching a fog whistle from leeward where could you pick it up earliest, on deck or aloft?

316. On the course from Pt. Betsey to Milwaukee in thick weather, how would you determine whether you were making good this course? How would you know if you were fetching westerly of the course? When would you begin to use the lead?

317. To give satisfactory results in the performance of this work, what instrument is necessary?

318. How do you know the speed of your boat in a fog?

319. You are running along in a fog on your natural gait. You give your engineer a check whistle and he slows down, how do you know how fast your boat is running without a log?

320. Over a low lying fog you can see the steam rise from a fog signal but can see nothing else. Fifteen-second intervals elapse from the time you see the steam till you get the sound of the whistle, how far are you from the whistle?

321. Can you judge your distance from a fog signal by the power of the sound? Why is it that many times you can hear a fog whistle more distinct at a given distance away than at a given distance that is not so far away?

322. If you knew you were in range of the sound of a fog whistle and you could not hear it what would you lay the cause to?

323. From the echo of your own whistle how could you determine approximately your distance off a high shore bank in foggy weather, with little or no wind?

324. What extra precautions do you take in a fog in the navigation of your boat?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—NO. 22.

221. What is the true bearing of Middle Neebish cut Rgs.?

222. If you had your boat heading on middle Neebish cut Rgs. and your compass reads W x N¾N, how would you steer with same compass and boat in same trim from a point 1 mile north of Whitefish Pt. light to a point 4 miles NNE from Copper harbor?

223. What is the correct magnetic bearing of Neebish island Rgs.?

224. When wishing to make the turn at the intersection of middle Neebish cut and Neebish island ranges what mark can be used to port slowly on in order to bring stern of boat on Neebish island ranges?

225. What is the true bearing of Middle Hay lake Rgs.?

226. What is the correct magnetic bearing of Frechette Pt. Rgs.?

227. What is the true bearing of Six Mile Pt. ranges?

228. How is Little Rapids cut marked at lower and upper ends?

229. If you had stern of your boat on Bayfield Rock ranges and your steering compass reads W x N½N, how would you steer with same compass and boat in same trim from a point 1 mile north of Whitefish Pt. light to a point two miles NNE from Manitou island lighthouse?

230. With stern of your boat in line with Vidal shoal ranges, compass in pilot house reads S 76° W, and compass on top of pilot house reads S 79° W, what should either compass read in order to be correct? Which of the two compasses is the nearest to being correct, the one in the pilothouse or the one on top?

QUESTIONS FOR OILERS AND WATERTENDERS.—NO. 17.

161. What is the lowest temperature that feed water can be admitted into any marine boiler?

162. What marine boilers have no fusable plugs and why?

163. What are the proper dimensions of a fusable plug?

164. What should be the thickness of a main steam pipe to carry 225 lbs. pressure per square inch?

165. What sized drill would you use to drill a new screwed stay bolt and how deep would you drill same?

165½. What will be the working pressure on a one-inch stay bolt fetched six inches by six inches centers?

166. What is the largest sized screwed stay bolt you may use?

167. What thickness should the strips be for a double-cut, riveted, seam steel plate one inch thick?

168. Suppose the boilers you were with carried 230 lbs. steam pressure per square inch, at what must your steam gauge correctly indicate beyond this pressure?

169. Where would you place a soft plug in a vertical tubular boiler?

COMMERCE OF LAKE SUPERIOR.

The report of the superintendent of Sault Ste. Marie canal shows that 5,787,320 tons of freight were moved through the canals during November, making a total movement to Dec. 1 of 50,192,835 tons. To arrive at the full season's movement, there must de added to this the December movement, yet to be computed, but the commerce is beyond all odds the heaviest that the canal has ever shown.

IN FAVOR OF SHIPPING.

At the annual meeting of the Boston Marine Society the following resolution was unanimously adopted:

That, we the Boston Marine Society, a society of upwards of 400 members, composed of shipmasters, merchants and others directly interested in the commerce of our country, do here, at our annual meeting, heartily and unanimously endorse senate bill No. 529 (known as the shipping bill) as passed by the senate.

It was also unanimously voted that a copy of the above vote be sent to each of the Massachusetts congressmen, and also to the Hon. Jacob H. Gallinger, of New Hampshire, chairman of the merchant marine commission.

The steamer D. R. Hanna left Lorain on her maiden trip Nov. 22, taking over 10,000 tons of coal to the head of the lakes. She will take wheat for storage at Buffalo on her last trip.

The executive committee of the Lake Carriers' Association met at Detroit last week but no business of a public character was transacted.

THE BELLEVILLE GENERATOR AND ECONOMIZER.

(From Navy and Army.)

About sixteen years ago it was generally recognized by those responsible for naval engineering design that a limit had been reached in both the pressure and weight of steam which could be safely produced in warships from a cylindrical (tank) boiler of a limited size and weight. It was, and is still, possible to produce from cylindrical boilers the necessary power, but at the same time the weight of material would be about double that of the water-tube type, and either the tonnage displacement must also be very largely increased, or some of the armor and armament must be sacrificed.

In a water-tube boiler there are a number of small tubes containing water and steam, while the flames and hot gases from the fire pass around the outside of these tubes before reaching the up-take and funnel. Each tube is thus subjected to an internal pressure of steam or water, and engineering science tells us that the thickness of the material of which each tube is made varies directly as the product of its diameter and the internal pressure. Thus a cylindrical boiler of about 15 ft. diameter, such as fitted in the "Hindustan," working under 210 lb. per square inch internal pressure, must have a thickness of about 1¾ in., while a Belleville boiler tube of 4 in. diameter is strong enough to resist a working pressure of 300 lbs. per square inch when only 1-18 in. in thickness. As a matter of fact, however, allowance has to be made for wear, and the lower rows of tubes next the fire in the Belleville generator are about 3-8 in. thick. The remaining tubes are thinner, generally about 1-5 in.

The modern Belleville boiler consists essentially of two principal parts—the generator, in which steam is formed from water partly filling the tubes, and the economizer through which the water passes on its way from the feed-pump to the generator. The economizer is thus actually a feed water-heater, and its position above the generator ensures an economy by robbing the hot gases of part of the heat which would otherwise pass away up the funnel without being utilized. The early Bellevilles were not fitted with economizers, and are thus

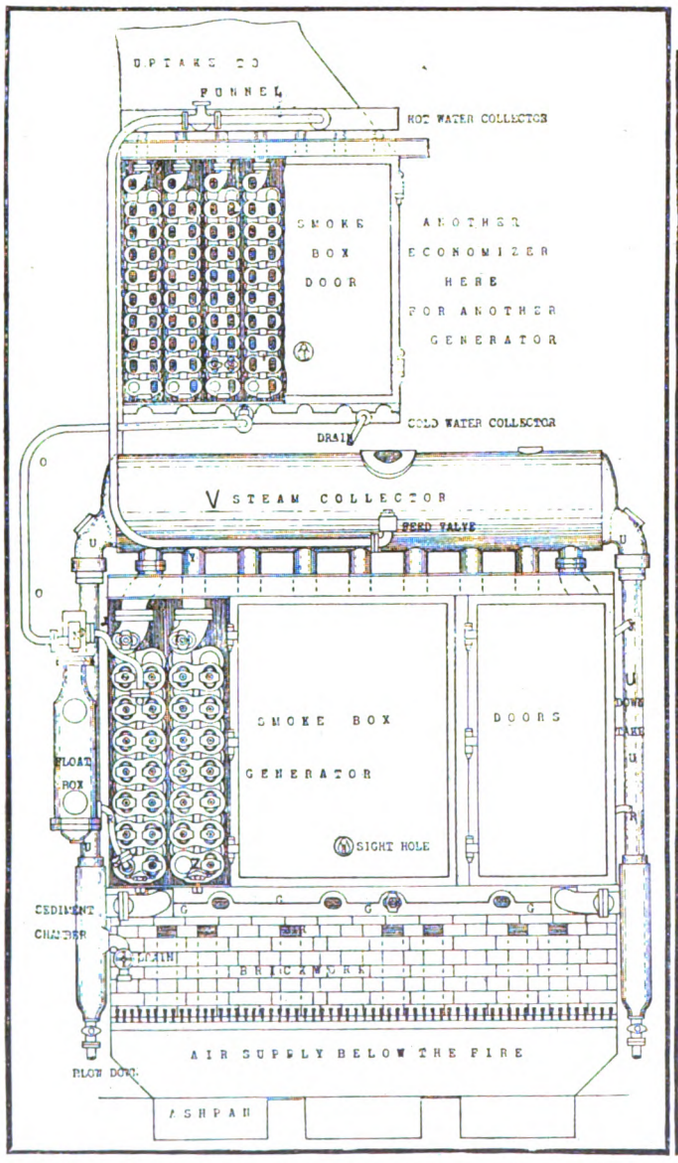


Fig. I.—Front view as seen from the stokehold platforms, but with the furnace, ashpit, and some of the smoke-box doors removed to show the interior. A down-take is shown at each end of the steam chest.

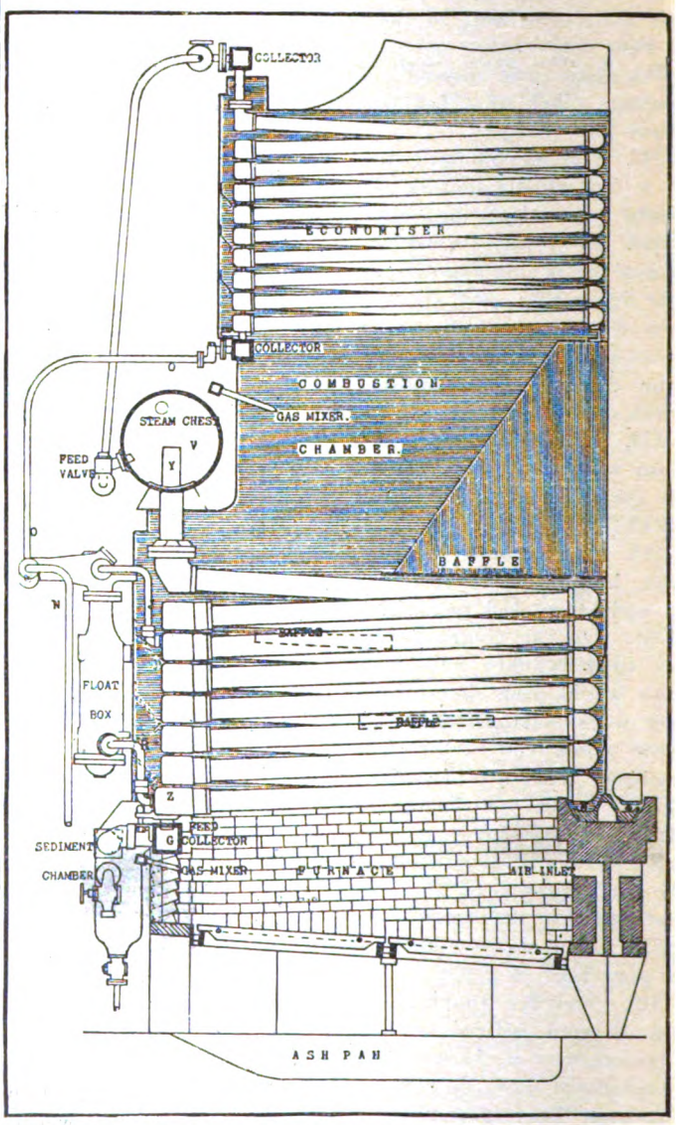


Fig. II.—Side view in section, showing the flattened spiral construction of the tube elements, with the general arrangement of the baffles and feed pipes. The down-take pipe, conveying the water from the steam chest to the sediment chamber, is hidden by the casing.

about 20 per cent less economical than the modern types.

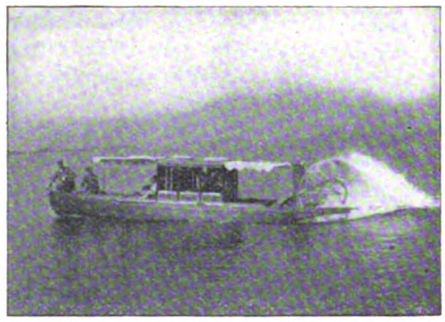
Fig. 1 shows a front view of the boiler with some of the smoke-box doors removed, to show the elements into which this class of boiler is divided. Each element is a sort of flattened spiral, composed of pairs of straight tubes, which are nearly horizontally arranged. Commencing from the lowest junction-box, Z, the tubes are inclined slightly upwards by raising opposite ends alternately (as shown in Fig. II). The junctions are formed by screwed joints at the ends of each two tubes, one of which is inclined downwards to the junction-box at the opposite end below, and the other upwards to the junction-box immediately above, and also at the opposite end. The system is exactly similar for both generator and economizer, but the tubes in the latter are only about 2 in. in diameter, which is about half that of the generator tubes. Each generator element is in open connection with a square-sectioned cross collecting pipe, G, which is called the feed-collector, at the bottom, and with the steam-chest or collector, V, through an up-take pipe, Y, at the top. The boiler shown in the illustration has nine generator and seven economizer elements, and at the stokehold end of each tube there is a small door, which is used for the examination and cleaning of the interior surface.

STERN WHEEL SHALLOW-DRAUGHT MOTOR BOAT.

Salvatore Orlando, engineer, of Leghorn, Italy, has designed a most serviceable stern wheel boat which will overcome the difficulties hitherto experienced in navigating the inland waters of many districts in northern Italy. The canals and lakes are uniformly very shallow, the Lake Massacinccoli being only 8 ft. deep in the center, decreasing to 12 in. in depth towards the edge, while the canals have only a depth of 2 ft. in hot weather, and are invariably choked with weeds. The employment of steam propulsion, using screw propeller, is under the circumstances impossible and no attempt has hitherto been made in these waters to use either steam or motor barges. M. Orlando, however, faced the difficulty by experimenting with a small stern wheel boat, the screw propeller not being favored because of the liklihood of it becoming clogged by the weeds and growth in the water. His boat, as shown in the accompanying illustration, is of the following dimensions: Length between perpendiculars, 24 ft. 7 in.; length over all, 31 ft.; beam, 5 ft. 9¼ in.; displacement, 1,800 metric tons; mean draught, 7.87 in. The machinery consists of a four-cylinder, 16-brake H. P. benzine motor, made by the Itala works, of Turin. The engines are placed well forward. In deep sea water, a speed of 8 knots was attained with this boat, but this speed was not reached in Lake Massacinccoli, while in the canals at their shallow summer level, a speed of only three or four knots was possible

STERN-WHEEL, SHALLOW DRAUGHT MOTOR BOAT.

These varying speeds led M. Orlando to use his boat in making experiments of the critical depth of water for given speeds, and the results are given below in his own words. "I first found over a measured distance the true speed of the boat in relation to the revolutions of the wheel, and got as results, 6.93 and 7.40 knots for from 49 to 52 revolutions, respectively. At the speed of



STERN-WHEEL, SHALLOW DRAUGHT MOTOR BOAT.

7 knots in water over 6 ft. 6 in. deep, the bow and stern waves took a well known form which was described by M. Marriner in his paper read before the summer meeting of the Institute of Naval Architects, in 1905. Our illustration shows the vessel moving in deep water. Steaming at 7 knots speed from the middle of the lake towards the shore, nothing particular was noticeable while the water was of a depth over 6 ft. 6 in.. On reaching shallower depths than this the stern waves increased in size, maintaining, however, the repeating form until on reaching the critical depth a very large stern wave suddenly formed, the stern of the boat dipped in a marked manner, and, owing to her very small inertia, and the great increasing of resistance due to this wave, the boat's movement was nearly stopped. The critical depth, M. Orlando says, he has repeatedly measured with great care, and he finds that it is on an average, 4.68 ft. If, he says, we apply the formula $V^2 = C \times D$ where V is the speed in knots, and D the depth of water in ft., to this case we obtain $C = \frac{(7)^2}{4.68} = 10.47$. This, he further says, agrees fairly with the figure 10 obtained by M. Marriner, and tends to confirm the conclusion that the critical depth depends upon the speed and not the size of the vessel.

PERSONAL.

H. H. Raymond, general manager of the Mallory line, New York, announces the following appointments effective Dec. 1: E. G. Warfield, freight traffic manager; W. J. Carroll, purchasing agent.

Mr. George McC. Jackson, formerly boilermaker on the U. S. M. S. St. Louis, has been appointed superintending boilermaker for the American line, succeeding the late Mr. James Edwards, who died recently at Southampton. Mr. Jackson is one of Harland & Wolff's young men, and is to be congratulated.

Charles E. and W. F. Peck announce the amalgamation of their firm with the firms of Albert Willcox & Co., and Walker & Hughes, forming the corporation of Willcox, Peck & Hughes, to continue their business as average adjusters and insurance brokers. The advantages secured by this consolidation are expected to result in more efficient and satisfactory service than ever before. The temporary offices of the marine and adjusting departments are at 27 William street, and the fire department at 58 William street. Branch offices will be maintained at Chicago, Cleveland, Buffalo, New Orleans, Minneapolis and Boston. The officers and directors of the new company are: Charles E. Peck, president; Wm. G. Willcox, Wm. A. Prime, and John C. Eustace, vice presidents; Joseph C. Hughes, treasurer; Gilbert W. Taylor, assistant treasurer; Percy S. Mallett, secretary. Directors: John C. Eustace, Charles Douglas Franks, Joseph C. Hughes, Percy S. Mallett, R. T. Marshall, E. P. Lenihan, Charles P. Molineux, Charles E. Peck, Wm. A. Prime, Charles Sayles, H. N. Townsend, R. L. Van Arsdale Jr., Wm. G. Willcox, Charles F. Wreaks.

CHAMBERLAIN'S ANNUAL REPORT.

Secretary Metcalf, of the department of commerce and labor, has received the annual report of Navigation Commissioner Chamberlain which states that on July 30, 1906, the documented merchant vessels of the United States numbered 25,006 of 6,674,969 gross tons.

In the decade American shipping on the Pacific has doubled, shipping on the great lakes has increased 69 per cent and is now one-third of our total tonnage. On the Atlantic and Gulf American shipping has increased only 29 per cent. In ten years the world's merchant shipping has increased about 45 per cent. It now requires 177,200 men to man all our merchant vessels and yachts.

The year's construction was 1,221 vessels of 418,745 gross tons. Only three ocean steamers were built. On the great lakes 40 steamers of 232,366 gross tons were built, three each over 7,000 gross tons, the largest ever built on the lakes.

The tonnage built during the current fiscal year up to Nov. 19 aggregates 203,000 gross and if the present rate of construction is not checked by strikes or delays in furnishing structural steel, the output of our ship yards will be the largest in half a century and will be close to the output of 583,000 tons in 1855, the year of our greatest construction.

Work is more evenly distributed on the seaboard and on the lakes than for some years. Of thirty-two ocean steamers building on the seaboard only two are for foreign trade and these two will operate under the postal subsidy laws of 1891.

The assemblage of large bodies of trained mechanics in our ship yards creates a condition especially favorable to a legislative project to begin to re-establish the American merchant marine in foreign trade next year, and the enactment of the merchant marine commission bill, which has passed the senate, is recommended. An American ship cannot receive a subsidy unless it carries a certain proportion of naval reserves. These reserves are volunteers, not conscripts, and the success of the measure thus depends on the willingness of competent American seamen to enroll as volunteers under direction of the navy department. The bill is thus founded on national defense. The expenditures for naval reserves are to be fixed by congress on estimates of the secretary of the navy. Expenditures for ocean mail steamers are to be fixed by congress on estimates of the postmaster general. The expenditures for general subsidies to cargo steamers and merchant sail vessels depend on numerous conditions, including carrying naval reserves, fixed in a written contract with the secretary of commerce and labor. Few federal appropriations are so rigidly safeguarded.

Quoting the resolution in favor of approved steamship communications adopted by the Pan-American conference at Rio de Janeiro last August, Commissioner Chamberlain publishes a full list of all the vessels in trade between the United States and South America during the first six months of this year. An American merchant steamer is never seen in the ports of Brazil, Argentina, Uruguay, Chile or Peru and only thirty-two American barks or schooners, manned by about 350 men, entered or cleared in six months in South American trade. Steam communication under any flag with South America from our Atlantic ports is virtually confined to New York, for while foreign steamers occasionally enter at Boston, Philadelphia or Baltimore, such entry is generally an incident to a voyage beginning or ending at New York. In trade with Brazil and Argentina are two 14-knot steamers, three 13-knot steamers and seven 12-knot, but the majority are slow cargo steamers. The report favors American mail lines to South America, provided in the merchant marine commission bill. The rate of $15,600 proposed for a voyage to Buenos Aires is moderate. The British government for some years has paid $12,600 a voyage for its mail line to Cape Town and the Argentine government is considering a proposition to pay $25,000 a voyage from Buenos Aires to European ports. Each of these three routes in round numbers is 6,000 miles outward.

A square-rigged vessel has not been built in the United States since 1902, and of our once great fleet of ships, barks and barkentines, only 276 of 322,000 gross tons remain. Some of them will never make another voyage. The completion of the Tehauntepec railroad next year will probably deprive such vessels of employment in moving the Hawaiian sugar crop. We must soon abandon the theory that training on a square-rigged ship is a necessary qualification of a deck officer of a steamer or the federal government must maintain square-rigged ships as training schools, alone or in co-operation with states, municipalities or steamship companies.

During the year 227,392 men have been shipped, reshipped or discharged by shipping commissioners. Of 126,754 shipped, 37,676 were native and 23,456 naturalized Americans. Of the aliens 14,517 were British subjects, 13,454 Spanish (mainly in West Indian and Central American trades), 6,477 Norwegians, 4,368 Germans and only 530 French.

The bill to abolish the discrimination against coasting sail vessels in pilotage charges in the states from Virginia to Texas is favored.

The revised international rules for lights on fishing vessels, which were adopted last spring by the principal maritime nations should be approved at the coming session to secure uniformity and because the United States led in the movement to improve the rules of the road at sea.

Tonnage taxes aggregated $967,322, the largest amount since the law was changed in 1884. American vessels paid $84,902. During the year only twelve per cent of the exports and imports of the United States were carried in American vessels.

END OF THE CLYDE SHIP BUILDING STRIKE.

After being on strike seven weeks, the Clyde shipwrights have decided to take the advice of their leaders and return to work on the old terms. The Glasgow branches of the men's union voted on Wednesday, Nov. 14, and it was felt that such a majority had polled in favor of ending the strike that it could not be effected by the ballot of Greenock Paisley and Renfrew which was taken on the following day. The result just made known show that 2499 men had registered votes in favor of returning to work, against 1,631 who were determined to continue the useless resistance. Work will be resumed almost immediately, and a week hence it is expected the Clydeside yards will have regained something like their old atmosphere of industry and prosperity.

In this connection Messrs. W. Denny & Co., Dumbarton, have booked orders from Japan for two large turbine steamers for the ocean trade in the far east. They have also received an order for another steamer for New Zealand. In view of these and other contracts the end of the Clyde ship building strike is viewed with satisfaction.

The Atlantic Works, Inc., 28th street and Gray's Ferry road, Philadelphia, recently received an order from the Vinyard Ship Building Co., Milford, Del., for one of their B-17 adjustable bevel band saw machines, which they make especially for ship yard work.

ITEMS OF GENERAL INTEREST.

Prospects are good for the successful floating of the Allan liner Bavarian.

The new armored cruiser California has just completed a four hours' endurance run. She averaged 22.22 knots per hour.

The steamer W. S. Porter for the Associated Oil Co. has been completed at the yard of the Newport News Ship Building & Dry Dock Co.

Orders have been placed with the Fore River Ship Building Co., Quincy, Mass., for three new steamers for the New England Gas & Coke Co.

In addition to the capital stock of $14,000,000, the Mallory Steamship Co., recently incorporated at Maine, will issue $3,000,000 5 per cent twenty-five-year mortgage bonds.

The schooner Keewadin is at the yard of the New London Marine Iron Works, New London, Conn., undergoing repairs to her hull. She will also be given a new keel.

The battleship Minnesota, built by the Newport News Ship Building & Dry Dock Co., Newport News, Va., made her trial trip from Rockland, Me., recently at an average speed of 18 knots an hour, fully meeting her contract requirements. The Minnesota is the first battleship to have undergone a trial before being commissioned.

The steamer Hendrick Hudson, of the Hudson River Day Line, is being equipped with a Bullock telltale fire annunciator, a device invented by C. S. Bullock, of Stratford, Conn., which is finding much favor among vessel owners. The steamer Plymouth, of the New England Navigation's Co.'s fleet, which is being rebuilt at Erie Basin by the J. N. Robins Co., will also be equipped with this device.

The Midvale Steel Co. has received an order from the Italian government for 2,100 tons of armor plate, its tender being $100,000 less than that of the Italian Terni factory. This bid of the Midvale Co. is about $131 per ton in excess of its bid of $345 a ton for Class A armor under which is obtained half the contract for supplying the armor for the new United States battleships South Carolina and Michigan.

The Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, Morris Heights, N. Y., are exceedingly busy with new construction, having under way at their yard a new 175-ft. steel twin-screw steam yacht and a new set of launches, life-boats and dinghies for F. H. Stevens' steam yacht Owera; a 45-ft. auxiliary ketch for A. H. Hubbel, and a 36-ft. auxiliary ketch for L. Q. Jones. Both of these boats will have Speedway gasoline engines, and are for use in southern waters, for which they will be ready by Dec. 1. Twelve Speedway gasoline engines were recently shipped to Buenos Ayres for motor boats in South America.

The Bureau of Yards and Docks has been awarded contracts aggregating about $175,000 of work in the Charleston and Norfolk yards. C. L. Muralt, New York, was given a contract by the Charleston yard for $85,000 for boilers and machinery, and the Norfolk yard has awarded the Heine Safety Boiler Co. contract for $57,178 for boilers and $30,500 to the D'Olier Engineering Co. for condensing apparatus and traveling crane.

The New Orleans & Tampa Navigation Co., of New York, which will operate steam vessels in the Gulf of Mexico between New Orleans and Tampa, was incorporated last week with a capital of $500,000. The directors are: George L. Craig, of Toledo; R. L. Caples, of New York; George B. Wilson, of Passaic, N. J.; B. L. Whitlock, S. McLenahan, John J. O'Leary and Thomas H. Franklin, all of New York.

The Japanese Steamship Co., operating between San Francisco, Honolulu, Nagasaki and Hong Kong, will add two big steamers to its present fleet. The new craft are building in Japan and will be 575 ft. long, 63 ft. beam, 39 ft. deep, having a carrying capacity of, 12,000 tons. The steamers will be equipped with Parsons turbine engines, capable of giving the vessels a speed of 19½ knots. The first of these vessels is to be put in commission in December, 1907, and the other some time in 1908.

Very recently the Barneson-Hibberd Co., of San Francisco, sold the once famous old sailer Two Brothers to the Pacific Freighting Co. for the sum of $7,000. The vessel will be converted into an immense barge and will be used by the new purchasers between Puget Sound and Alaska. The Two Brothers was built at Farmingdale, Me., in 1868 by the Bradstreet Brothers, noted ship builders at that time, and has had an unusually interesting career, both in the Atlantic and Pacific.

Mr. Hollis Burgess has sold the gasoline launch Belterre, owned by G. H. Hamilton, of Allston, Mass., to Harry W. Dudley and J. Samuel Hodge, of Boston. He has also sold the cruising knockabout Paloma, owned by Norman S. Powell, of Boston, to John T. Arnold, of Providence, and two 18-footers, Wink, owned by George D. Bussey, of Winthrop, to F. L. Vulte, of New Rochelle, N. Y., and Chercot, owned by Dr. Morton Prince, of Boston, to R. T. Paine 2nd, of Brookline, who has recently bought the Herreshoff 46-ft. sloop Humma.

Bids on contracts No. 25 and 27, New York state barge canal, opened by the superintendent of New York Public Works, were as follows: Atlantic, Gulf & Pacific Co., New York, contract No. 25, $1,754,236; Kinzer Construction Co., Chicago, contract No. 27, $972,210. The state engineer's figures on these two contracts were $1,849,831 for contract No. 25 and $998,920 for contract No. 27.

The new steel ocean-going tug Gypsum King, built by the Burles Dry Dock Co., of Port Richmond, S. I., had a successful trial recently. She is the largest and most powerful ocean tug on this coast, and will be used for towing barges between New York and Nova Scotia. She is constructed entirely of steel, is 163 ft. long, 29 ft. 6 in. beam, and 19 ft. 4 in. depth. Her engines, triple expansion, 1,200 H. P., will drive her 13 knots an hour. Her cost was $130,000. The Gypsum King replaces a tug of the same name which was lost in the Bay of Fundy nearly a year ago.

The American Blower Co., Detroit, is doing a very large business with the ship building companies on its vertical self-oiling engines, types A and E. During the past year and a half it has furnished the Great Lakes Engineering Works, Detroit, with forty-nine of these engines and now has orders on its books for sixteen more. Out of the entire lot there has not been a single repair order. The company has just received a good sized order from the Canadian Ship Building Co., Toronto, Ont., for fans and engines. The first order, placed some time ago, was conditional on the satisfactory performance of the engines.

At the annual meeting of the stockholders of the Aurora Automatic Machinery Co., a subsidiary company of the Independent Pneumatic Tool Co., at its office at Chicago recently, the following officers were elected: John P. Hopkins, president; W. O. Jacquette, first vice president; J. D. Hurley, second vice president; C. E. Erikson, treasurer; A. B. Holmes, secretary. Directors: James B. Brady, W. O. Jacquette, John P. Hopkins, John D. Hurley, A. B. Holmes, M. S. Rosenwald, Simon Florsheim, J. J. McCarthy, C. E. Erikson. A quarterly dividend of three per cent on the stock of the company was declared.

The strike at the Wyandotte yard of the American Ship Building Co. has been settled.

LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

BOW FRAMING AND PLATING.

Fig. 100 shows the bow framing plan. Frame No. 11 shows the collision bulkhead and is laid out as explained in the second article in the issue of August 9 of the MARINE REVIEW.

The frames and floor plates are made from molds as explained in the first article, Aug. 2. A mold is made for each piece representing the bow framing which is composed of frames, beams, stanchions, stringers, breast-hooks and ridge bars. The spar deck on this plan is simply the floor of the forecastle as shown by Fig. 101. The angle stringer between the forecastle deck and floor of forecastle is the line of the spar deck. This angle stringer is made from molds supplied from the mold loft.

A mold is made to the shape of the ship's side and serves the purpose of laying out four angles, two for each side of the vessel. These stringers are not connected to the shell plating being only riveted to the frames on the inside and connected at the fore end with breast hook.

The mold for the shell shape is drilled for riveting eight diameters apart and the holes for the rivets connecting the stringers to the frames are simply gauged from the heel of the angle, care being taken to have a little more material than the diameter of the hole from the edge of the hole to the edge of the flange of the angle. Spar deck Fig. 101 runs to the shell and connected to the shell plating with angle clips the length of the frame space, an angle is run forming a stringer bar and connected to the frames in the usual stringer angle style.

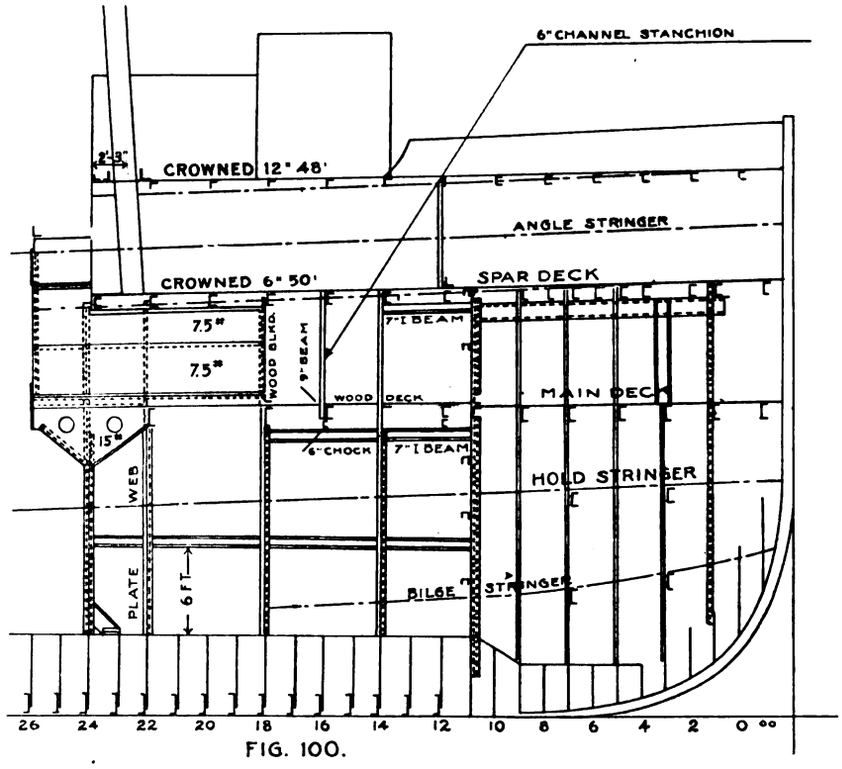


FIG. 100.

For this deck a mold is made for the tapered plates, stringer angles and clips to the shell for one side of the vessel and for parallel plates one mold does for them all. In this case 15 plates are marked from one mold and two plates from each mold for the balance of the deck plating.

The stringer angle is marked from a mold made to the shape of the ship's side and the holes for the rivet connections to the frames are gauged from the heel of the angle. The shell clips are marked from the deck plating molds for the deck riveting and a space mold for the shell rivet holes. The beams for this deck are marked with strip molds. One mold for the deck plating rivet holes does for all the beams by making a change of two holes for the angle connecting the plating and frames and the shell by connecting the deck and shell together. This is done by using a mold with a round end as explained in Article 14, main deck stringer 9, Fig. 85.

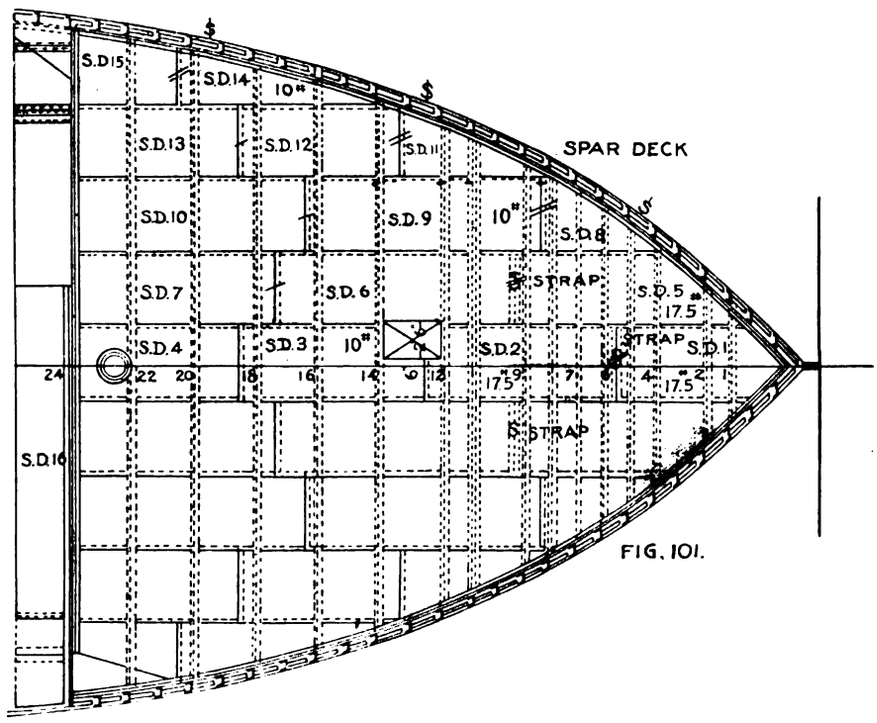


FIG. 101.

The stanchions riveted to beams 1, 3, 5, 7, and 9 are marked from one mold and the holes for ridge bar rivets are gauged to suit the width of flange of ridge bar.

A mold is made for each beam bracket but one mold serves the purpose of marking all the rivet holes for same on the beams. A batten with the width of each beam scratched in is used and a bevel for the ends furnished on a board. In this way all the beams in the fore peak are marked as well as the deck, Fig. 101. Fig. 102 shows the main deck and for this deck plating a mold is made for each two plates or the one side of the vessel. The beams, stringer angle and shell clips are laid out similarly to the deck above.

Fig. 103 shows the plan of parting stringers. These stringers are all laid out from molds as shown by plan.

All the angles are marked from the mold made for the plate for the rivet holes connecting angles to stringer plate. The shell flange rivet holes are marked

with a mold for that purpose to suit the frame space. Molds are made for the flanges of clips to belt frames, brackets and clips connecting face bars to belt frames, stringer brackets and beams.

By this method all the work including the shell plating is laid off from the mold loft floor.

In Scotland the frames, beams and floor plates are put up and the same

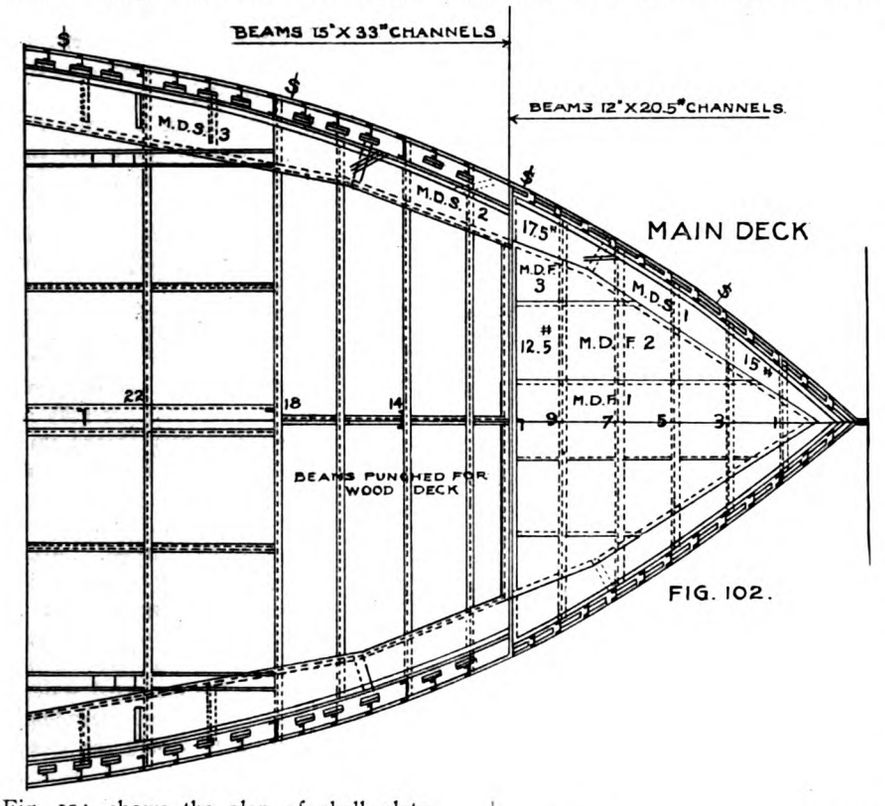


FIG. 102.

Fig. 104 shows the plan of shell plate starboard H1. Fig. 105 shows the shell expansion forward. Fig 106 shows a mold for stem plate.

The stem plate mold represents the plate, Fig. 104, flattened out which is all there is to laying out a stem plate from the mold loft floor.

The plate edges are obtained from a level line about the center of the plate which are measured around the heel of the frame and the length of the plate over the stem is secured by putting the plate in the half breadth plan as shown by Fig. 104. The flanging of the stem plate is done in the bending rolls so that the amount of material necessary is easily obtained by flanging a piece of plate before putting the lines for the plate in the half breadth plan.

The most important thing in laying out a stem plate from the mold loft floor is to see that care is taken in drilling the holes square in the stem bar.

The safest plan is to have the stem bar drilled before the reverse stem plate is laid off, then the mold can be applied to the reverse side to test the fairness of the drilling of the stem.

The mold shows shell plate H1, starboard and in this case there is no fear of the stem holes, seeing they are marked from this side but the holes on the port side of the stem may be angled enough to make bad holes if care is not taken in drilling the stem.

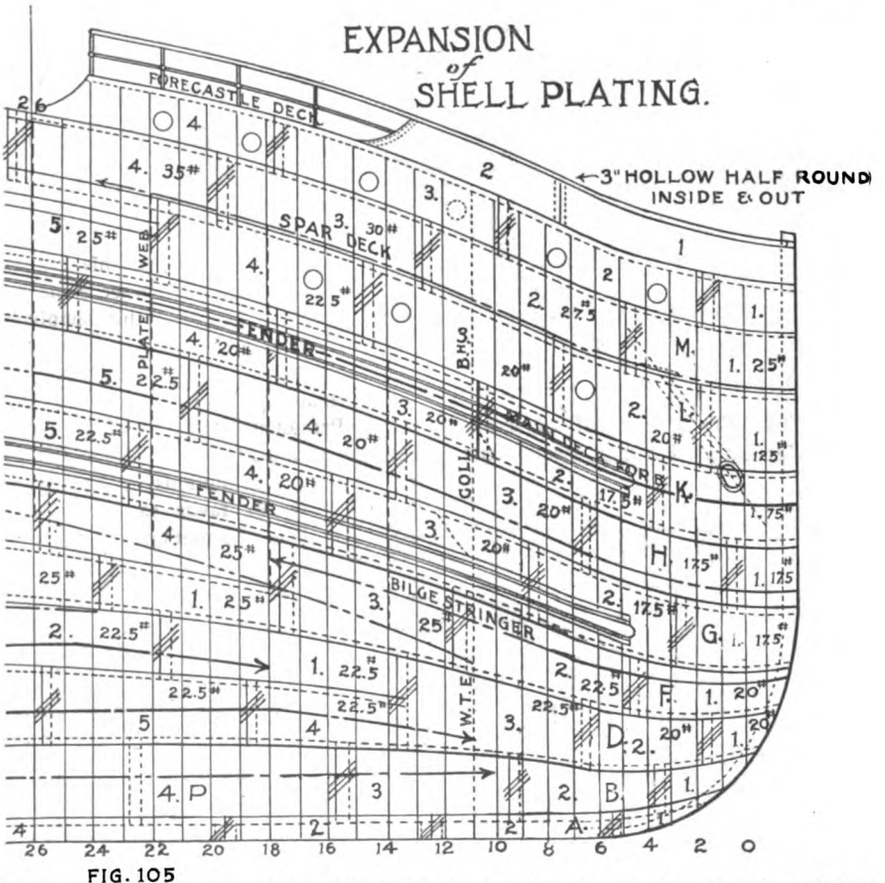


FIG. 105

faired up with ribbands as explained in the seventh article on shell plating and all the different pieces lifted from the boat and erected in rotation.

The cost of this work is all governed from the midship size of material. If Fig. 101 was in line with the spar deck, it would be considered the spar deck and paid as such. The main deck ends would be paid the same as at amidships, so with all the different parts.

The bow framing and plating can be done on the lakes one-third less than by the method practiced in Scotland.

PERSONNEL AT LORAIN YARD.

I am indebted to Mr. Robert Logan, general manager of the American Ship Building Co., for details of these articles and Mr. Frank La Marche, general superintendent and his assistants of the Lorain yard for their courtesy during my visits to the Lorain ship yard. The photo shows Frank La Marche and his assistants who built the J. Q. Riddle in forty-five working days. These men have been employed in the Lorain yard for a number of years and have a wide experience in ship building. No. 1 shows Mr. La Marche, No. 2, A. C. Paton, superintendent of construction and No. 3, Mr. Frank W. Brown, loftsman.

These articles concern Mr. Paton and Mr. Brown more than any of the others.

Mr. Paton had a thorough training in Dumbarton, Scotland, in ship building prior to coming to the United States; he was connected with the Cleveland Ship Building Co., from the beginning of their ship building ven-

ture and has remained with them ever since.

Mr. Paton has shown himself to be a very capable man in handling men and he has the good will of every man under him. He has risen from the old methods of ship building to the new and he deserves credit for the progress he has made in improving on the mold work and the high standard of work he puts out.

Mr. Brown has been brought up in the mold loft from the Cleveland Ship Building Co., Cleveland, to the Lorain yard and he certainly has made great progress in the mold work. The neatness and accuracy of his work is very creditable and the dispatch is wonderful.

In laying off and making the molds of the J. Q. Riddle he had as assistants, two men and two boys.

He is a young man and of a very progressive nature with a splendid future ahead of him.

During my visits to the Lorain yard a vessel was on the stocks plated and no riveting done. The fairness of the holes was easily seen which went to show the stage of perfection the mold work had reached.

One thing that can be said for the foremen in the Lorain yard of the American Ship Building Co. is that they work well together and are always ready to help each other in whatever turns up for welfare of the employers' interest.

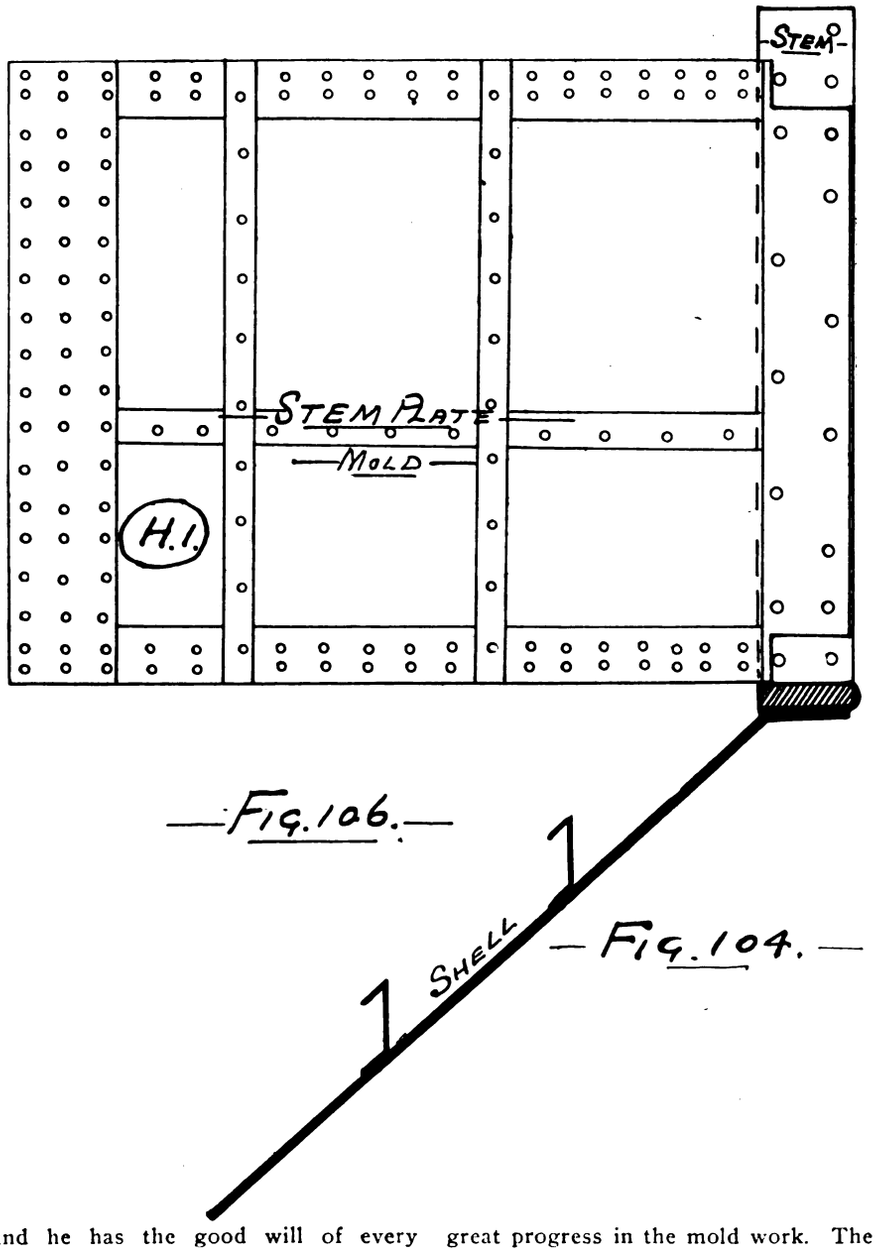


FIG. 106.

FIG. 104.

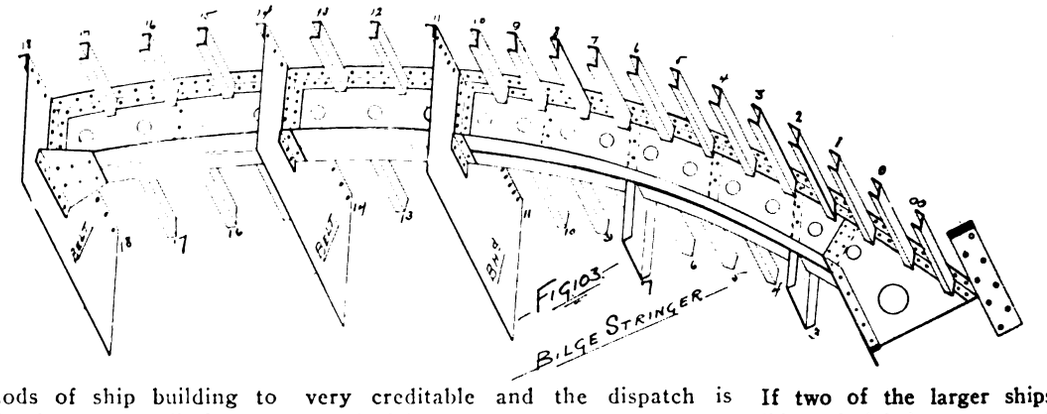
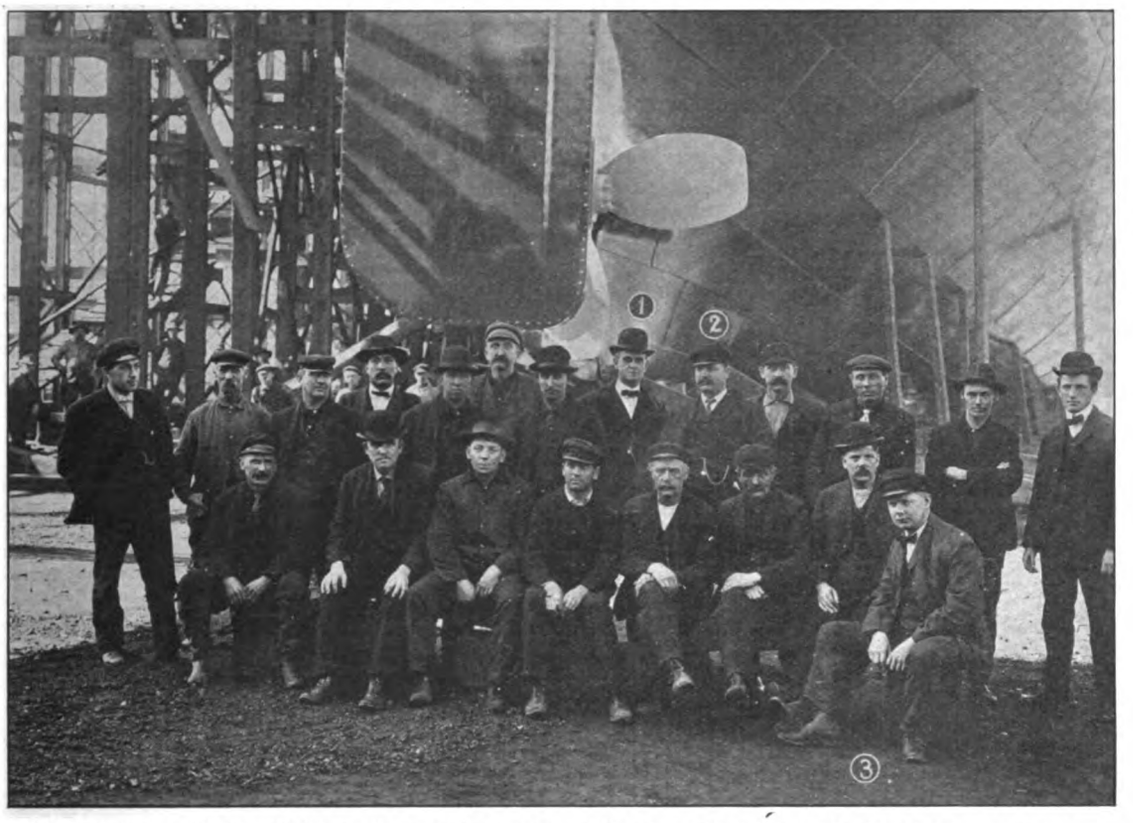


FIG. 103.

AUXILIARY STEERING GEAR.

It would seem as though no argument were necessary to prove the necessity of an emergency steering gear aboard ship. The control of a ship is completely at the mercy of its steering gear. As a matter of protection an emergency gear should be carried. Accidents to steering gear may happen without warning and if an emergency gear is not instantly available serious damage may be done to the ship. There are dozens of places in the restricted waterways of the lakes where strandings would inevitably occur should the steering gear give out.

The Akers Steering Gear Co., Old Colony building, Chicago, claim that they have the only successful emergency steering gear on the market. The company certainly submits evidence in support of its claims. Ever since the advent of the 5,000-ton ship it has been apparent that a second or emergency steering gear is necessary. Every other feature connected with the handling and navigation of the modern steamer has been improved upon with the exception of the most essential adjunct to uninterrupted control. Of late years both the number and size of ships on the great lakes has increased immensely, but the channels are the same as ever, limited as to room. If two of the larger ships should collide and sink in any one of a dozen different places in the rivers, navigation would be completely suspended until they were removed—a matter of several days.



THE STAFF AT THE LORAIN YARD—NO. 1 IS MR. LA MARCHE, NO. 2 MR. PATON, AND NO. 3 IS MR. BROWN.

While no actual record has been kept, a large number of strandings and collisions have been due to derangement of steering gears. The regular steering gear with its almost clock-like mechanism is necessarily more or less complicated. A small pinion may bind or stick for only a brief period, a nut or key become loose, even the most trifling thing can happen to render the whole system temporarily inoperative. Under such conditions in a crowded channel, a complete and separate steering gear immediately available is absolutely necessary to prevent collision or stranding. Moreover, it is in these narrow channels with their sharp turns that the regular steering gear gets the hardest and most severe strain. It is natural that the man at the wheel should become nervous and turn the wheel much faster than the builder ever intended that the transmission and engine should be run. If any weakness exists, it is at this crucial time that it will make itself known. The most of these breakdowns are repaired in a few minutes by the engineer, but meanwhile the ship is drifting. If the ship is damaged, the underwriters of course pay the bills, but the vessel owner is not compensated for time lost—and time is a considerable item in the necessarily brief season of lake navigation. Every 24 hours' delay to a 10,000-ton steamer means a heavy loss to the owner. If the ship is equipped with the Akers emergency gear, there is no danger of it passing from the control of the officer in charge at any crisis. The change from the regular steering gear to the emergency is quite simple, and is made in from ten to fifteen seconds from the bridge. The marine underwriters have had the Akers emergency gear carefully inspected and tested, and they have strongly endorsed and recommended same in a resolution passed at the last annual meeting of Inland Lloyds, and now give boats equipped with it a special note in the register. The new steamers Wm. A. Rogers, B. F. Jones, James Laughlin and Charles Weston are equipped with the emergency steam gear. It will also be installed in the steamers W. M. Mills, L. S. DeGraff, W. D. Kerr and the great passenger steamer now building for the Detroit & Cleveland line. The company has also recently received an order for the equipment of the new 10,000-ton steamer Wilton, building for the Shenango Steamship Co.

The Mianus Motor Co., Mianus, Conn., has just put out a catalog descriptive of their marine gasoline engines. Every part of the engine is intimately described and illustrated. The catalog will be sent to anyone upon request.

CARMANIA'S YEAR.

When the Cunard liner Carmania returns home from New York she will have completed a year's sailing, with results in excess of expectations, says the London correspondent of the *Glasgow Herald,* and comparable with the best first year's performance of any Atlantic liner. It has been decided that she will, on arrival a week hence, be taken off the station in order that a thorough examination may be made to ascertain the effect on the turbines of a year's working. During the year the turbines have not been touched, and have worked voyage after voyage almost without attention. As regards economy, there has been from the beginning a steady improvement. It was thought best to run the ship when new at a moderate speed. The consequence was that the economy was not so good as if the turbines had been driven at their maximum speed—a result which is inherent in the system. In recent voyages there has been a speeding-up, and now the coal consumption is practically the same as for the best quadruple-expansion engine —the difference is less than six per cent. When, next year, the turbines are worked at their maximum the Carmania will excel in economy even the Caronia.

PULVERIZED COAL ABOARD SHIP.

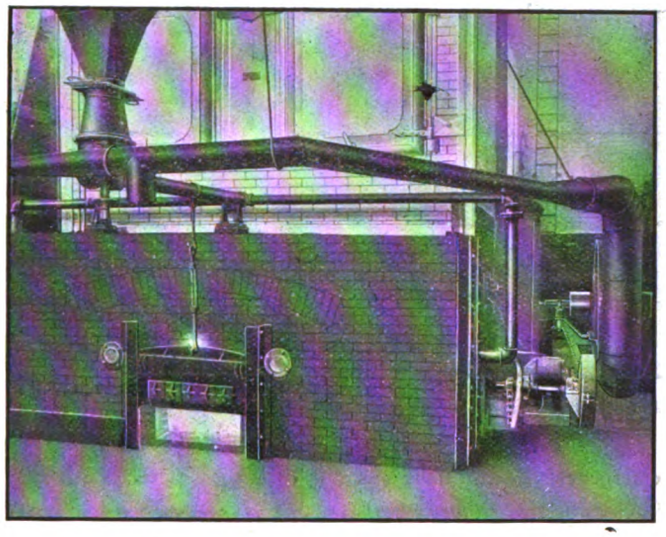
According to an announcement made at Buffalo last week by Mr. C. C. Card, general manager of the International Combustion Corporation of Buffalo, the problem of running lake freighters on an economical basis so far as fuel goes has been solved with the corporation's apparatus for burning pulverized coal. It is definitely asserted that boats can be run much cheaper on account of the saving in fuel and labor.

Where vessel owners have hesitated heretofore to put powerful engines in their boats because they require so much fuel to keep running, it now appears that all this is to be changed with the Packard system of burning pulverized coal. The boats will not only develop greater horsepower on a smaller amount of coal, but they will be fired by one man on a watch where three or four are now needed.

Figured on a conservative basis, the estimated saving on a lake freighter on the fuel by the use of the system would run 15 to 30 per cent over and above the present method of firing coal. This would include the saving in wages of the firemen whose services would be dispensed with. This would simplify lake navigation because the fuel problem is confessedly the most serious one to consider.

Owners by the use of the pulverized fuel burner will be able to inaugurate another economy in addition to saving the cost of labor. They will be relieved of the proposition of buying new grate bars every so often for the simple reason there are none in the burners. This is a considerable item in the course of a season.

By the Packard system of burning pulverized coal, the coal is ground so it will pass through a screen of from 40 to 60 mesh, where it has heretofore been considered necessary to grind the coal so fine that 95 per cent would pass through a 100 mesh screen. After being pulverized, the coal is fed into a hopper in front of the boiler at the bottom of which is a patent feeder that is positive in its operation, and which feeds the coal into a current of air produced by an ordinary centrifugal pressure fan. This air carries the coal into the furnace where combustion takes place under ideal conditions, viz., an extremely hot furnace, finely divided coal uniform in size, and a sufficient quantity of air to secure complete combustion.



SHOWING INTERNATIONAL COMBUSTION CORPORATION'S APPARATUS INSTALLED UNDER A BABCOCK & WILCOX BOILER IN THE EDISON ILLUMINATING CO'S PLANT, AT DETROIT.

Among the advantages claimed for burning pulverized coal by the Packard system, are that it is the most economical and complete method of burning coal; labor expenses are greatly reduced since one intelligent fireman can operate fifteen to twenty boilers, adaptability and ease of regulation to meet all requirements; decreased wear and tear of furnaces or boilers with no grate bars to burn out or renew; saving of time in starting up and rapid stoppage in case of necessity; less labor required to remove refuse; intimate contact of fuel with air whereby the minimum excess is employed over the theoretical volume in waste of heat thus avoided. And last but not least, since complete combustion is obtained, it is absolutely smokeless at all times.

In order to install the system on boats, it would either be necessary to have small grinding machines aboard, or have regular fuel docks where pulverized coal could be put aboard. This, however, is considered a minor detail in view of the complete success thus far achieved.

There are other advantages derived by using the Packard pulverized fuel burner. Eliminating smoke, as it does, its use will mean that the lake harbors will be kept free from smoke, the signals on the boats when they are passing at close hand will be more easily distinguished on account of the absence of smoke, and the boats, themselves, will always look more shipshape and clean than ever before. Realizing this, the management of some Cleveland boats are now figuring on installing them on some of those boats this winter.

The apparatus has been in successful use for the past five years under all the boilers and annealing furnaces of the Erie Malleable Iron Co., at Erie, Pa. The success there has resulted in its installation in other plants, and experts claim that it will be found not only on all the lake freighters, but also on the passenger steamers in the next few years. It is broadly claimed that the burner will revolutionize the burning of soft coal.

TRADE NOTES.

The Rockwell Engineering Co., 26 Cortlandt street, New York, has recently put out a variety of bulletins descriptive of their various specialties, among them the Rockwell rivet heating furnaces, one of the most ingenious devices on the market. It will heat rivets up to 1½ in. diameter and will keep any gang supplied and may be operated with fuel, oil or gas. Other bulletins are devoted to the flue welding furnaces, brazing furnaces, metal melting furnaces, annealing and hardening furnaces, pot furnaces for lead and other soft metals, heating machines for annealing, hardening, tempering and coloring, and fuel oil burning appliances. All of these catalogs are excellent specimens of the printer's art and are well worth preserving.

The *American Wire Rope News* is a quarterly issued by the America Steel & Wire Co., Rookery, Chicago, Ill. The October quarterly is just out and contains considerable matter of interest to users of wire rope, especially an article devoted to derrick rope calculations. The quarterly contains a great deal of information and is rich in half-tone illustrations of standard constructions of American wire rope. The uses of rope are, of course, infinite, and this quarterly should be of interest to many lines of industry. It can be had for the asking.

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ENGINEERS' NUMBER

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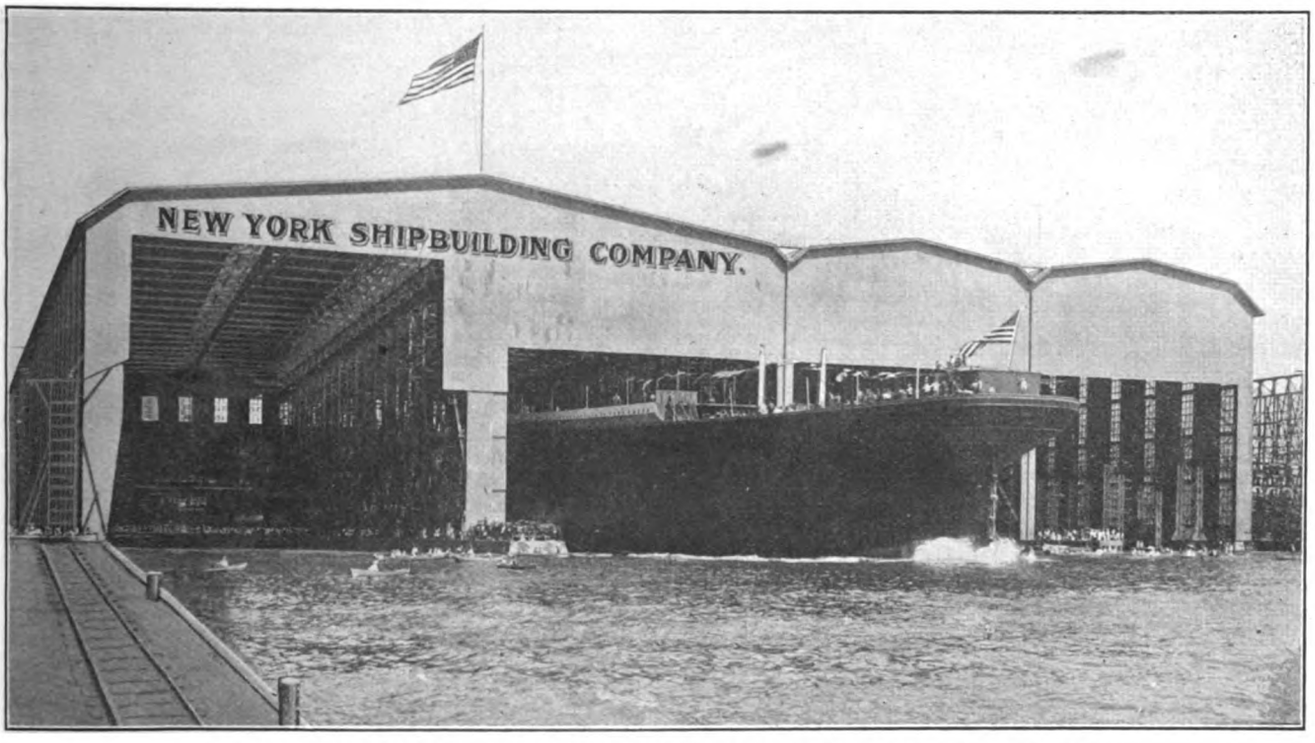
New York Shipbuilding Company

Main Office and Works, Camden, N. J. **New York Office, 12 Broadway**



Launch of "Mongolia," Pacific Mail S. S. Co., 615 feet long, 65 feet beam, 51 feet deep.

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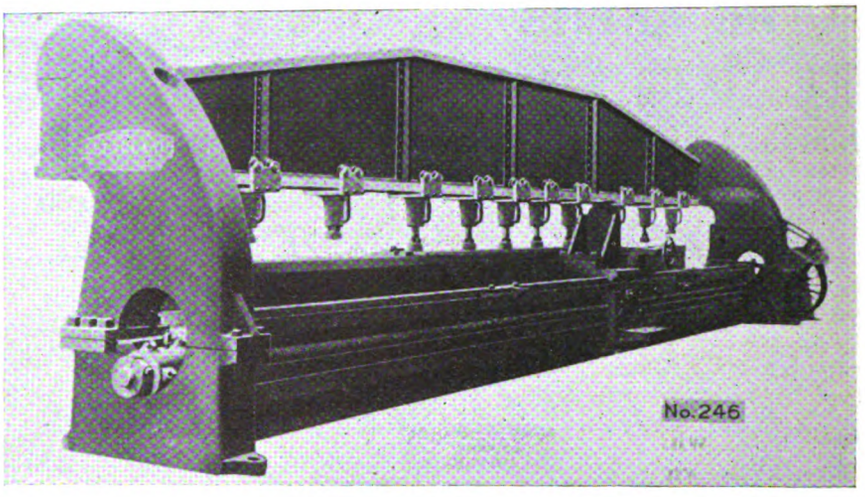

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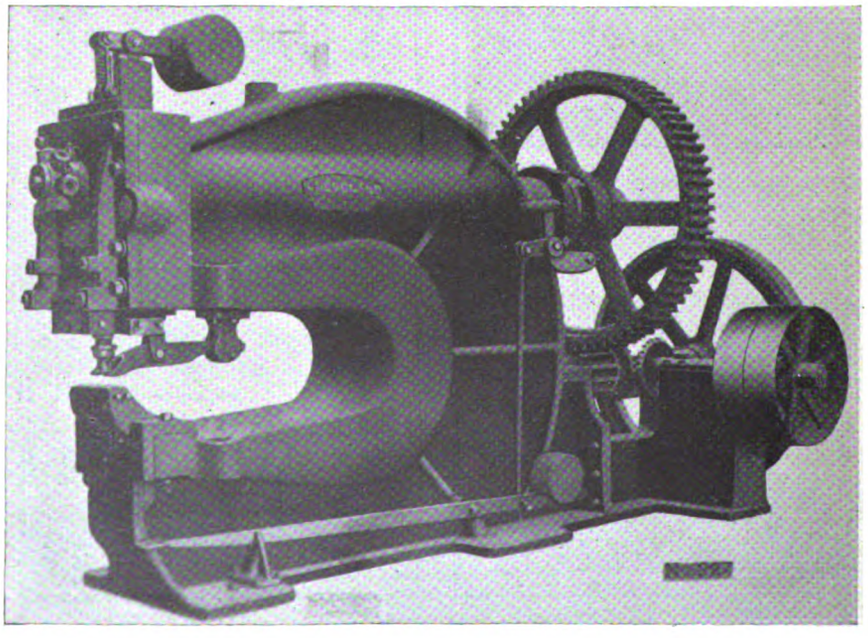

8' x 12' FLOAT—45 PERSONS—450 CUBIC BOAT FEET

WE CAN SAVE YOU

75% deck space 50% weight 90% cost of maintenance

THE CARLEY LIFE FLOAT

Constructed of Copper, Cork, Canvas and Cordage.
Requires no davits or tackle.
Standard sizes range from six to sixty-seven persons capacity.

LIFE BOATS **LIFE PRESERVERS**

Send for Illustrated Catalogue.

CARLEY LIFE FLOAT COMPANY

F 4 & 5 Produce Exchange Building, New York.

"RAINO"

For Hard Service

"Raino" is a guaranteed absolutely waterproof cloth.
For ships' officers, yachtsmen, seamen, etc., it is the ideal waterproof garment.
"Raino" is very light, clean and neat looking. Far superior to either oilskins or rubber. It will not rot, nor is it stiff, heavy, oily or foul smelling.

After two years of the hardest kind of army and naval service tests in all parts of the world hundreds of officers declare it the most durable waterproof garment made.

"Raino" officer's Long Coat $6.30 net
"Raino" Medium Coat..... 5.40 "
"Raino" Jacket..... 4.50
"Raino" Overalls..... 2.50 "
"Raino" Soft Squam Hat... 1.00

Write for Samples and Price List P.

E. A. ARMSTRONG MFG. CO.

(Makers of the famous Armstrong Uniforms.)
Write for prices on Uniforms.

315-321 Wabash Ave., Chicago.

ARMSTRONG GUARANTEE.

A week's trial. Rain, Hose or Shower. If not satisfactory express back at our expense. Money returned. Show our faith.

Shoes That FIT FEET and FANCY

retail for

$3.50-4.00-5.00-600

and are for sale at the

EMERSON SHOE STORES

in Cleveland, Toledo, Buffalo, and Detroit

also in

Erie, Pa.	G. W. Carter & Co.	Lorain, O.	Francis Bros.
Conneaut, O.	E. Johnson.	Amherst, O.	Jacob Baus.
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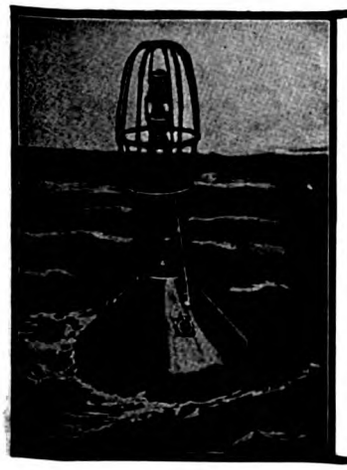
Painesville, O.	Jones & Nye.	Elmore, O.	A. Weis & Son.

Factory at The Emerson Shoe HONEST ALL THROUGH **Rockland Mass.**



Pintsch Gas Lighted Buoys

BURN CONTINUOUSLY

FROM 80 TO 365 DAYS AND NIGHTS WITHOUT ATTENTION AND CAN BE SEEN AT A DISTANCE OF SIX MILES.

Brilliant & Steady Illumination. Economical & Reliable in Operation.

Adopted by the English, German, French, Russian and United States Light House Departments for Channel and Harbor Lighting; over 1900 gas buoys and gas beacons in service.

Controlled by the

SAFETY CAR HEATING & LIGHTING COMPANY

160 Broadway, NEW YORK CITY.

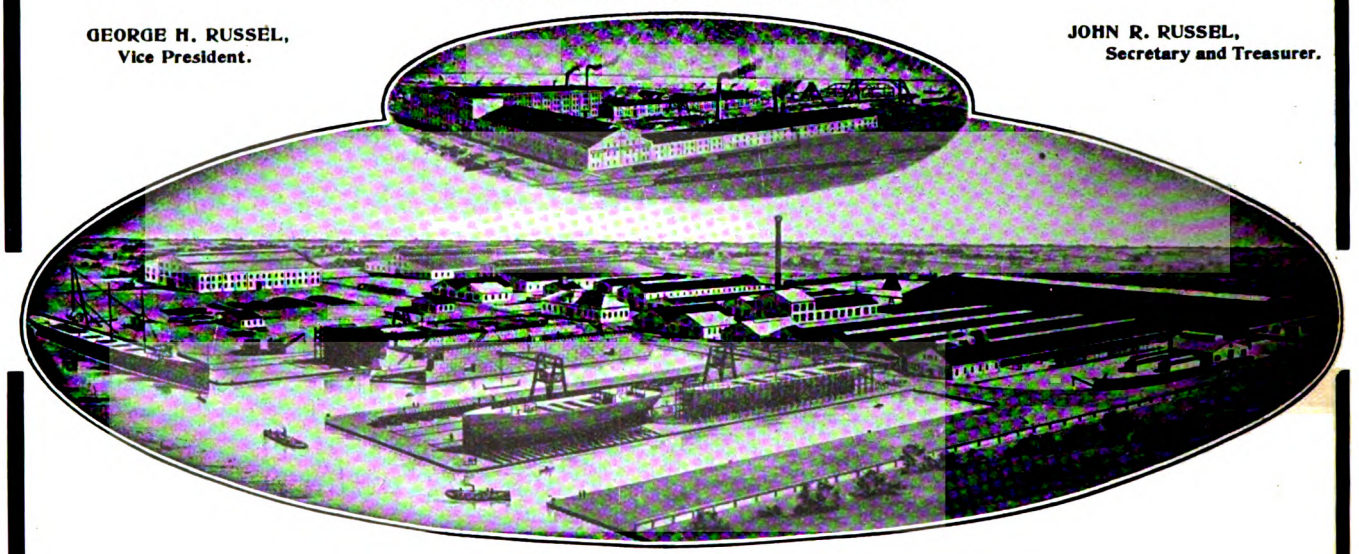
GREAT LAKES ENGINEERING WORKS

DETROIT, MICH.

ANTONIO C. PESSANO, President and Gen. Mgr.

GEORGE H. RUSSEL, Vice President.

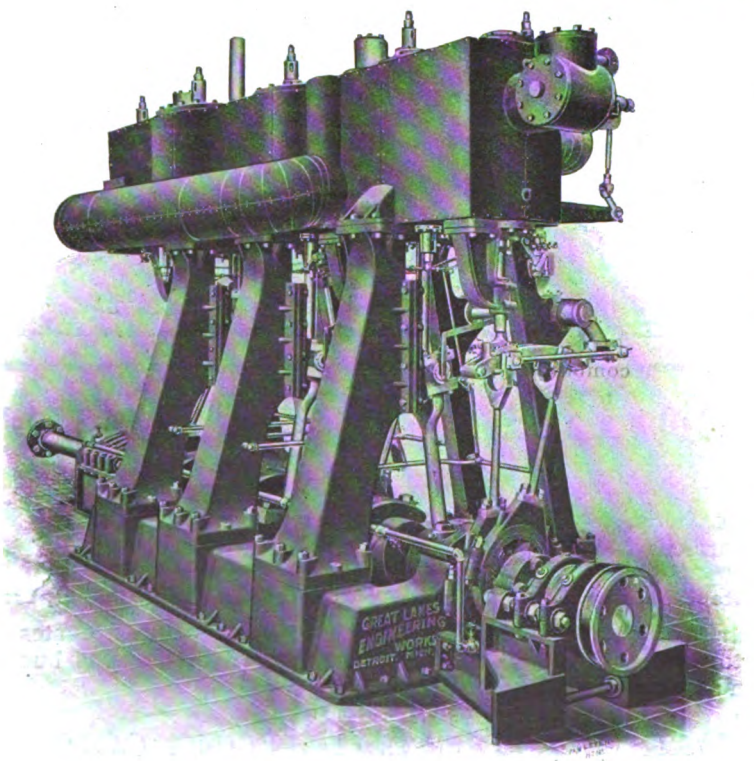
JOHN R. RUSSEL, Secretary and Treasurer.



Steel Ship Builders

Floating Dock

Marine Engines



Marine Repairs

Hydraulic Dredges

Hydro Carbon System

Propeller Wheels

WANTED and FOR SALE

PROPOSALS.

U. S. Engineer Office, Vicksburg, Miss., Nov. 20, 1906. Sealed proposals for the construction of six wooden, four creosoted or three steel material barges for use in the Third district, improving Mississippi River, will be received at this office until 12 o'clock, noon, Dec. 20, 1906, and then publicly opened. Information furnished on application. G. M. Hoffman, Capt. Engineers.

I HAVE VESSELS of most every kind—from 10 tons to 6,000 tons—to sell for their owners, at reasonable prices. Anybody wishing to buy or sell a boat should call on or write Fred A. Bradley,
11 Mooney-Brisbane Bldg.,
Buffalo, N. Y.
Insurance Agent.

FOR SALE.

VERTICAL ENGINE.

One triple-expansion marine type vertical engine, 11¼-inch, 18-inch, 29 x 18-inch stroke. Inquire, Public Lighting Commission, No. 40 Atwater Street East, Detroit, Mich.

Boilers for Sale.

Five Scotch Boilers, allowed 160 lbs, steam. Good as new. ERIE MACHINERY CO., 729 Garfield Bldg., Cleveland, O.

STEAMER PEERLESS.

FOR SALE.—Steamer Peerless, fully equipped for freight and passengers. Address, D. E. Sullivan, suite 1212, Ashland block, Chicago, Ill.

For Sale.

1,000 h. p. fore and aft Neafie & Levy compound Engine; surface condenser; independent pumps.

Two 12-foot Scotch Boilers.
One 13½-foot Scotch Boiler.
One 10 16-25 x 16 triple expansion Engine.

Three 150-h. p. Almy Boilers.
One 200-h. p. Tregurtha Boiler.
One 14 30 x 24 fore and aft Engine and condenser.

One Williamson steering Engine.
One 10 k. w. electric lighting Set.
One 15 k. w. electric lighting Set.
One Providence Windlass, 50 fathoms 1½ in. chain.

Two thrust Shafts and Bearings, 8½ in. diameter.

MARVIN BRIGGS,
17 Battery place, New York, N. Y.

Steamer for Sale Cheap.

The lighthouse steamer Haze, 145 ft. long, 27-ft. beam, 9-ft. draught, 500 tons capacity, 300 horsepower engine and boiler, suitable for passenger or freight business, fully equipped. Steam capstan, donkey boiler. Jacob Ullman, 46 Lloyd street, Buffalo, N. Y.

FOR SALE.

To close the Estate of the late Wiley M. Egan, the undersigned will receive proposals for the purchase of all, or a two-thirds interest in each of the freight Steamers Philip D. Armour, John Plankinton, Wiley M. Egan and R. P. Fitzgerald.

All proposals should be submitted by Dec. 10, 1906. Right reserved to reject any and all bids. For further particulars address,
Arthur C. Helm, Managing Executor,
Estate of Wiley M. Egan, Dec'd.,
214 Postal Telegraph bldg.,
Chicago, Ill.

WANTED TO BUY FOR CASH Passenger Boat, length 70 to 80 ft. Beam 16 to 18 ft., light Draft. Must be good runner, single deck preferred. In writing give full description of Hull, boiler and engines. Address L. E. Eggert, Muskegon Heights, Mich.

WANTED.—A good stone scow, about 800 tons capacity or over. Give particulars and price. Apply Box 106.

GOULD'S NAUTICAL SCHOOL,
265 MARCY AVE., CLEVELAND, O.
Established 1894.
Full and complete instructions in Lake and Ocean Navigation; also the Laws of Magnetism as applied to the compass, its effects, adjustments, etc. Will open about Dec. 10th.

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PLANS AND SPECIFICATIONS FURNISHED.

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FOR SALE.

One fore and aft Compound Marine Engine with cylinders 27 and 50 by 40-inch stroke. Inquire of the Montague Iron Works, of Montague, Mich.

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CHAS. E. & W. F. PECK

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BOSTON, 153 Milk St.
BUFFALO, 914 The Fidelity Bldg.
CLEVELAND, 1006-1008 Rockefeller Bldg.
CHICAGO, 1114-15 Royal Insurance Bldg.
REPRESENTED BY
C. T. BOWRING & CO., (Insurance) LTD.,
5 and 6 Billiter Ave., LONDON,
and at "LLOYD'S" LONDON.
HULLS AND CARGOES.

We place insurances in the most advantageous markets, employing, in the interest of our clients and with equal facility, all Foreign and Home companies, at the best procurable rates and terms.

We Represent Only the Assured

Alphabetical Index of Advertisers

on page 65 this issue.

The Blue Book of American Shipping, Marine Directory of the World, $5.00

BUYERS' DIRECTORY OF THE MARINE TRADE.

For a more complete classification than that represented by advertisers in The Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, Marine and Naval Directory of the United States, published by The Marine Review, Cleveland.

[See accompanying Index of Advertisers for full addresses of concerns in this Directory.]

AIR COMPRESSION, HOISTS.
Great Lakes Engineering Works....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works....Detroit.

ASH EJECTORS.
Great Lakes Engineering Works....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley....Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E. .....Chicago.
MacDonald, Ray G.....Chicago.
Maytham, Frank.....Buffalo
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon .....Cleveland.

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.....Brookline, Mass.

BENDING MACHINES
Cleveland Punch & Shear Works Co. ..... Cleveland.

BLOCKS, SHEAVES, ETC.
Boston Lockport Block Co.....Boston, Mass.

BLOWERS.
American Blower Co., Detroit, Mich.

BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

BOILER COMPOUNDS.
The Bird-Archer Co.....New York
Dearborn Drug & Chemical Works..Chicago.
State Manufacturing Co...Cleveland.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Atlantic Works..East Boston, Mass.
Briggs, Marvin.....New York.
Chicago Ship Building Co..Chicago.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.
Kingston Foundry & Machine Works .....Oswego, N. Y.
Lake Erie Boiler Wks.....Buffalo
Maryland Steel Co.....Sparrow's Point, Md.
McLaughlin Iron Wks ..Ashtabula, O.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water Tube Co..New York.
Newport News Ship Building Co..Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co..... ....Duluth, Minn.
Ohio Machine & Boiler Co.....Cleveland.
Quintard Iron Works Co.....New York.
Roberts Safety Water Tube Boiler Co. .....New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co....Detroit.
Toledo Ship Building Co.....Toledo.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons.....Philadelphia.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works..Detroit.
Lunkenheimer Co.....Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co..... Cleveland.
G. H. Williams Co.....Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A.....New York.
Upson-Walton Co.....Cleveland.

CAPSTANS.
American Ship Windlass Co.....Providence, R. I.
Dake Engine Co.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

CHAIN SURVEYORS, HOISTS.
Brown-Hoisting Machinery Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co.....Boston, Mass.

CHARTS.
Penton Publishing Co....Cleveland

CHECK VALVES.
Scoville Check Valve Co., Ashtabula, O.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons.....Brookline, Mass.

CLOTHING, WATERPROOF.
Armstrong, E. A. Mfg. Co...Chicago.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co....Cleveland.
Pittsburg Coal Co.....Cleveland

COAL AND ORE HANDLING MACHINERY.
Brown-Hoisting Machinery Co.....Cleveland.

COMPASSES.
Ritchie, E. S. & Son.....Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works....Detroit.
Wheeler Condenser & Engineering Co.....New York.

CONTRACTORS FOR PUBLIC WORKS.
Breymann Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....Buffalo.
Great Lakes Dredge & Dock Co....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...Milwaukee.
Standard Contracting Co..Cleveland.
Sullivan, M.....Detroit

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

Buyers' Directory of the Marine Trade.—*Continued.*

CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co..... .... Cleveland.

CUTTING OFF MACHINES.
Cleveland Punch & Shear Works Co. ..... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.... .... Buffalo.
Great Lakes Dredge & Dock Co.. .... Chicago.
Hickler Bros. ....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Starke Dredge & Dock Co., C. H... ....Milwaukee.
Sullivan, M.....Buffalo.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.
Superior Iron Works...Superior, Wis.

DRILLING MACHINES.
Cleveland Punch & Shear Works Co. ..... Cleveland.

DRY DOCKS.
American Ship Building Co..... .... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co..... .... Chicago
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co..... .... Detroit
Great Lakes Engineering Works.... .... Detroit.
Lockwood Mfg. Co..... .....East Boston, Mass.
Milwaukee Dry Dock Co..... ....Milwaukee.
Newport News Ship Building Co... .....Newport News, Va.
Superior Ship Building Co..... .... Superior, Wis.
Tietjen & Lang Dry Dock Co..... ..... Hoboken, N. J.
Toledo Ship Building Co.....Toledo.

DYNAMOS.
General Electric Co..... ....Schenectady, N. Y.

ELECTRIC HOISTS AND CRANES.
General Electric Co..... .....Schenectady, N. Y.

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co..... .....Schenectady, N. Y.

ENGINE BUILDERS, MARINE.
American Blower Co., Detroit, Mich.
American Ship Building Co..... ..... Cleveland.
Atlantic Works, East Boston, Mass.
Briggs, Marvin.....New York.
Chicago Ship Building Co., Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.
Fore River Shipbuilding Co..... ..... Quincy, Mass.
Great Lakes Engineering Works.... ..... Detroit, Mich.
Hall Bros. ..... Philadelphia.

ENGINE BUILDERS—Continued.
Lockwood Mfg. Co..... .....East Boston, Mass.
Maryland Steel Co..... .....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co.... .....Newport News, Va.
New York Ship Building Co..... .....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co..... ..... Superior, Wis.
Thropp, J. E. & Sons Co..... .....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co., New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. ..... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Furstenau, M. C..... Philadelphia.
Hynd, Alexander ..... Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James ..... Cleveland.
Roelker, H. B.....New York.
Wood, W. J.....Chicago.

FANS.
American Blower Co., Detroit, Mich.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co.....Troy, N. Y.
Wheeler Condenser & Engineering Co. ..... New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co..... .....Schenectady, N. Y.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co.... ..... Cleveland.
Fore River Shipbuilding Co..... ..... Quincy, Mass.

Ohio Machine & Boiler Co..... .... Cleveland.

FLUE WELDING.
Fix's S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co., Detroit.
Toledo Fuel Company, ...Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works, New York.

GAS BUOYS.
Safety Car Heating & Lighting Co.. ..... New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ..... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co.....Cincinnati, O.

GENERATING SETS.
General Electric Co..... .....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..... .....Jersey City, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.
Cleveland Punch & Shear Works Co. ..... Cleveland.

HEATING AND VENTILATING APPARATUS.
American Blower Co., Detroit, Mich.

HOISTS FOR CARGO, ETC.
American Ship Building Co..... ..... Cleveland.
Brown Hoisting Machinery Co..... ..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co..... .....Grand Haven, Mich.
General Electric Co.....New York.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co..... .....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works.... .... Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The..... ..... New York.

ICE MACHINERY.
Great Lakes Engineering Works.... ..... Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros.....New York.
Lunkenheimer Co. ..... Cincinnati.
Penberthy Injector Co..... ..... Detroit, Mich.

INSURANCE, MARINE.
Atlantic Mutual Insurance Co..... .....New York.
Belcher, Fred P.....Winnipeg.
Elphicke, C. W. & Co.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F..... .....New York and Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.
Vance & Joys Co.....Milwaukee.

Buyers' Directory of the Marine Trade---*Continued.*

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong Cork Co.....Pittsburg.
Carley Life Float Co.....
.....New York, N. Y.
Drein, Thos. & Son.....
..... Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas.....
..... Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ..... Cincinnati.

LUMBER.
Martin-Barriss Co. ..... Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....
.....East Boston, Mass.
McLaughlin Iron Works, Ashtabula, O.
Ohio Machine & Boiler Co.....
.... Cleveland.
Superior Iron Works.Superior, Wis.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia

MARINE RAILWAYS
Hickler Bros., Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF,
Crandall & Son, H. I.....
.....East Boston, Mass.

MARINE TORCHES.
Marine Torch Co.....Baltimore.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York

MECHANICAL DRAFT FOR BOILERS.
American Blower Co., ...Detroit.
American Ship Building Co.....
..... Cleveland.
Detroit Ship Building Co., Detroit.
Great Lakes Engineering Works....
..... Detroit.

METALLIC PACKING.
Katzenstein, L. & Co., New York.

MOTORS, GENERATORS—ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Ritchie, E. S., & Sons.....
..... Brookline, Mass.

NAVAL ARCHITECTS.
Curr, Robert .....Cleveland
Hynd, Alexander .....Cleveland
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland
Wood, W. J.....Chicago

OAKUM.
Stratford, Oakum Co.....
.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co...New York.

PAINTS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc. ..Philadelphia.

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co....
.... Chicago.
Hickler Bros..Sault Ste. Marie, Mich.
Hubbell Co., H. W...Saginaw, Mich.
Parker Bros. Co., Ltd.....Detroit.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M.....Detroit.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland, O.

PLANERS.
Cleveland Punch & Shear Works Co. ..... Cleveland.

PLANING MILL MACHINERY.
Atlantic Works, Inc....Philadelphia.
Cleveland Punch & Shear Works Co. ..... Cleveland.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

PRESSURE REGULATORS.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co.....
..... Cleveland.
Atlantic Works ..East Boston, Mass.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Shipbuilding Co.....
..... Quincy, Mass.
Great Lakes Engineering Works....
.... Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
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